# Evaluation of CREP Riparian Buffers in Washington State

**Prepared for the**
**Washington State Conservation Commission Board Members**

CONSERVATION RESERVE ENHANCEMENT PROGRAM

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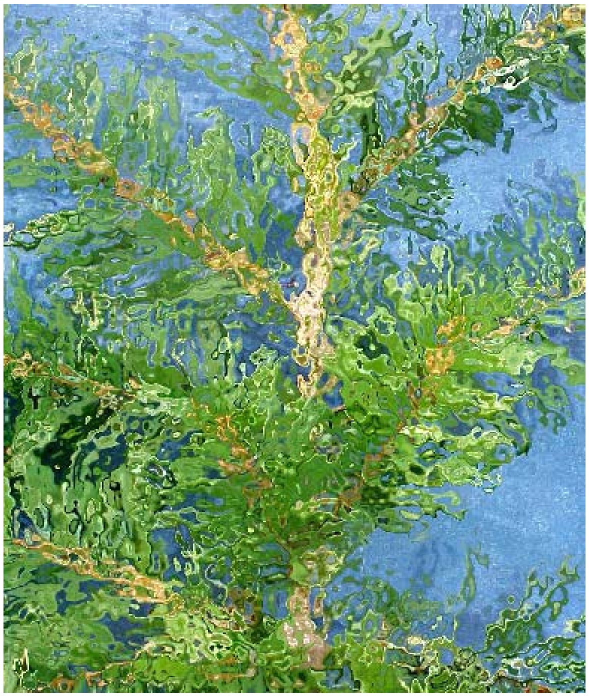

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## Introduction

Riparian zones are the areas immediately adjacent to streams, lakes, and other water bodies. They are unique, important areas for not only fish and wildlife habitat, but also for the health of the waterbody, which usually has multiple human uses as well. The type of vegetation within the riparian zone is crucial, as different types of vegetation have different functions. Tree and shrub roots hold streambanks together, stabilizing channels, decreasing erosion, and creating fish habitat (Bjornn and Reiser 1991, Montgomery and Buffington 2001). Overhanging trees shade water, maintaining cool water temperatures and contributing leaf litter, which serves as food for the organisms that in turn provide food for fish (Bjornn and Reiser 1991, Bisson and Bilby 2001, Naiman et al. 2001). Mature trees in the riparian zone provide important functions when they fall into streams to become large woody debris (LWD) because LWD stabilizes streambeds and banks, holds spawning gravels, creates pools that provide resting areas for salmonids (Bilby and Bisson 2001). Grasses filter pollutants from soil and aid in bank stability and sediment trapping (Knutson and Naef 1997, Welch et al. 2001, Fischer and Fischenich 2000). Invasive species such as reed canary grass and Himalayan blackberry are not effective at most riparian functions, and their rapid growth often replaces the native, functional plants that comprise a healthy riparian zone.

In Washington State, the current conditions of most riparian areas are predominantly listed as poor (53%) with 9% poor-fair, 18% fair, 13% good, and 7% data gaps (Smith 2005). In many areas of the state, riparian conditions have been listed as one of the major limiting habitat factors for salmonid production (Busby et al. 1996, Myers et al. 1998, Smith 2005). Because riparian conditions have a direct effect on water quality and stream habitat, they are key problems to address, not only for salmonid production, but also for watershed health.

Agriculture is a primary land use in Washington State. Washington State ranks 6$^{th}$ in the nation for the value of crops, and agriculture is Washington State's largest employer, contributing about 20% of the state's gross production (Canty and Wiley 2004). Agriculture covers 21% of the land area in the state with coniferous forest covering 37% and urban lands comprising 2.5% (Cassidy et al. 1997).

In Washington State, about 37% of salmon streams on private land pass through agricultural lands (NMFS and USFWS 2000), and because much of the agricultural land is located in or near historic high value floodplain and salmon habitat, it is important that efforts continue to develop opportunities to not only improve riparian habitat for healthy watersheds, but also to maintain viable agriculture. Once land is converted to more intensive development (urban and industrial), the prospects to preserve or restore habitat near streams greatly decrease and environmental impacts increase. Between 1982 and 1997, about

20% of the farmland in the Puget Sound region was lost to other uses, especially in King and Snohomish Counties where urban growth has been high (Canty and Wiley 2004).

The Conservation Reserve Enhancement Program (CREP) is an important tool to improve riparian habitat while lessening the farmer's financial burden for restoration and conservation. The program began in 1998 with the first signed contracts in 1999, and is cooperatively administered by the Washington State Conservation Commission and the U.S.D.A. Farm Service Agency (FSA). It is voluntary, and offers financial incentives for farmers to restore native vegetation to buffers along salmon streams and to preclude agricultural activities in those areas during the contract duration (10-15 years).

The goals of the CREP program (USDA 1998) are to:

- Reduce water temperatures to natural ambient conditions.
- Reduce sediment and nutrient pollution by more than 50%.
- Stabilize streambanks.
- Restore 3,000 miles of stream condition (has increased to 10,000 miles).

Since the program began in Washington State, there have been 576-signed contracts, 9565 acres of riparian buffer planted at an average width of 150 feet and spanning a length of 553 miles (Debbie Becker, Conservation Commission, personal communication). Because habitat values increase when fragmentation is reduced, projects that are contiguous to one another are greatly desired. Since 1999, 329 of the 576 contracts are contiguous with other CREP projects. However it should be noted that many more CREP projects are also contiguous with restoration projects implemented under other programs. For example the Nooksack Salmon Enhancement Association has been restoring stream buffers for over 20 years in Whatcom County.

The program has had a positive effect on local economies. Over 3.7 million seedlings, 975,863 feet of fencing, and 154 water systems (including springs, wells, troughs, and pipeline) have been purchased from in-state vendors (Debbie Becker, Conservation Commission, personal communication). In addition, $1,008,045 is paid each year to landowners by the U.S.D.A. as a rental payment for the protected buffer.

The purpose of this assessment is to evaluate the current status of riparian buffers developed under the CREP program in Washington State. How successful has the program been and what actions are needed to increase its success in the future? Specifically, this project examines:

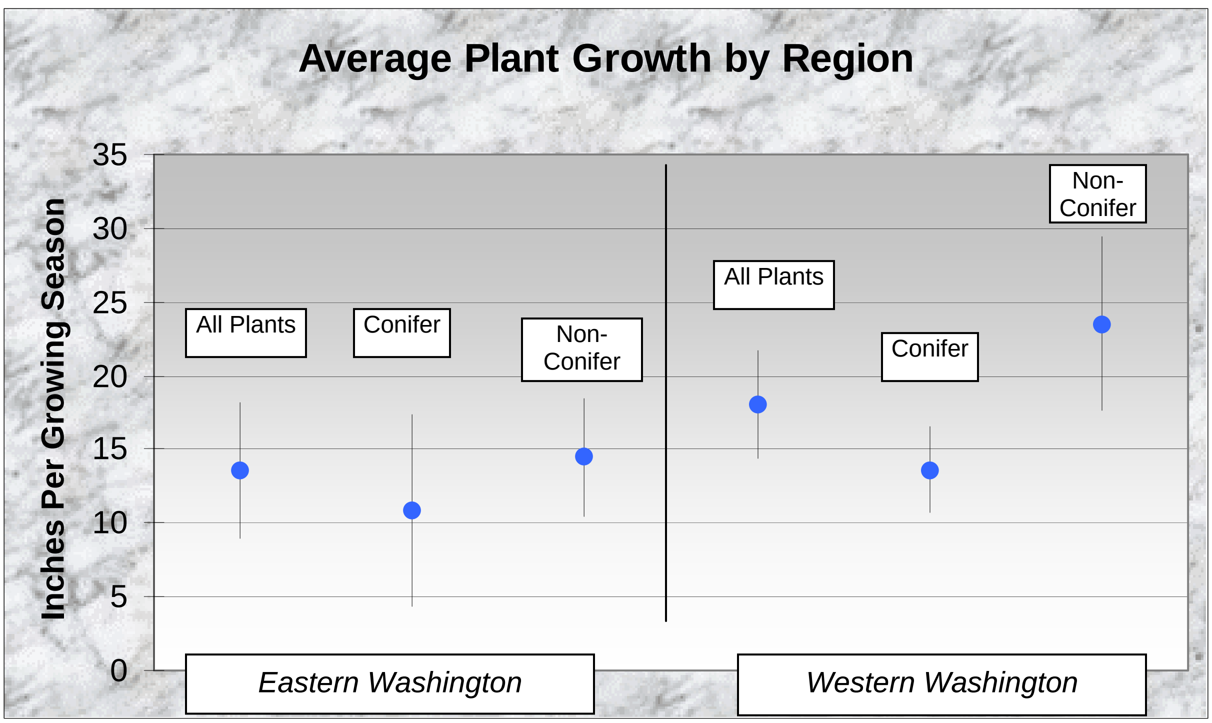
- The growth rates of CREP plants by plant type and by site
- The percent survival of CREP plants by site
- The density of plants, and thinning or replanting activities
- Plant diversity by district and region

- How well CREP projects address large stream reaches (Type 1, 2) versus smaller streams
- How many CREP projects benefit multiple salmon or steelhead species
- How many projects benefit an ESA listed salmon or steelhead species
- What problems have been encountered
- What procedures have been used either successfully or unsuccessfully for these problems
- What suggestions districts have to improve the program

**Results**

The CREP plants in Washington State are successfully surviving and growing. Growth rates are high for both the arid regions in the east and the wet areas of the west with no significant difference between the two regions in overall plant growth and conifer growth (Figure 1). Deciduous growth on the west side of the state was greater than all other types of plants in all regions. The average age of the sampled sites was 3.5 years.

**Figure 1. Mean CREP plant growth per growing season with 95% confidence limits.**




Plant survival was excellent at nearly all of the sampled CREP sites. The median percent survival was 95% in eastern Washington and 92.6% in western Washington. Mean survival was 77% in eastern Washington and 87.5% in western Washington. In general, CREP plant survival in Washington has been very successful with only a few sites experiencing large losses. Those losses were due to continued drought conditions in eastern Washington and flooding in western Washington. The measured survival percentages are also higher than the assumed survival of 80-85% in the Natural Resources Conservation Service (NRCS) plant stocking guidelines.

The diversity of plant types within a riparian zone is important because different plant types are more effective than others for different functions. For example, grasses are better filters than shrubs and trees, but trees provide shade and habitat, and shrubs are most effective at bank stabilization (Fischer and Fischenich 2000). However, diversity can be negatively impacted when the density of trees, especially long-lived conifers, is too high. The current conifer density of the Washington CREP projects is well below the high and moderate thresholds used by Berryman et al. (2004), while some western Washington sites are above the U.S.G.S. threshold at this time. Overall plant densities (all woody plants) follow the NRCS specifications, which have varied over time and are currently 300-400 stems per acre. Most western Washington CREP sites are at or above that density, while eastern Washington sites are more variable. New guidelines are being developed to allow more flexibility in plant density and to be more site specific. At this time, most of the projects are young. The average age of the sites is 3.5 years. It is likely that additional plant mortality will occur and density levels will decrease.

As time goes by, the density and diversity should be evaluated on a site-by-site basis with thinning or replanting occurring at sites deemed too dense or not diverse. This is better accomplished by local districts that can analyze on a site-specific basis to determine whether they have an appropriate density for their plant species to support a diverse riparian buffer. Along with density considerations, sites should be monitored for diversity and if natural diversity does not occur, underplanting may be necessary.

### Buffer Widths

The current minimum buffer width for a CREP project is 30% of the active floodplain of the stream, and can range from 35 to 100 feet depending on the site. The actual buffer cannot be smaller than the minimum at any point in the project. The maximum buffer width that can receive a rental payment is 180 feet based upon the average width of the buffer. The landowner can choose to enroll the minimum buffer width or anywhere up to the maximum buffer width of 180 feet. National Resource Conservation Service (NRCS) standards must be used to restore the riparian buffer.

There are numerous other buffer width standards in the literature; many of them are based upon tree height. The tree height is the site potential tree height, which is defined as the average maximum height of the tallest, mature, dominant trees for a given site class (USFS 1994). Average site potential tree heights are

175’ in western Washington, 120’ in eastern Washington, and 90’ at high elevations as reported in NMFS (2000), but these are generalized averages, and actual values should be estimated for a more localized area.  Soil maps provide the site index and species suited to a given site.

Buffers of 30% of tree height yield half or more of the full benefits of five major riparian functions are addressed (FEMAT 1993, NMFS 2000, Fischer and Fischenich 2000).  These functions include shade, leaf litter, soil moisture retention, bank stability, and nutrient/pollutant filtering, which together comprise many of the water quality functions.  Using the average site potential tree heights as reported in NMFS (2000), this indicates that significant benefits can still occur with buffer widths that range from 30 to 53 feet, depending on the local site potential tree height and an establishment of a diverse buffer.

These values are in general agreement with those reported in Fischer and Fischenich (2000).  They conducted a thorough review on riparian buffer widths and functions nationwide, and have the following recommended buffer widths by function.  For water quality protection, the width should be 5-30 meters (16-98 feet).  For stream stabilization, 10-20 meters is recommended (33-66 feet).  Detrital input requires 3-10 meters (10-33 feet), and flood attenuation is 20-150 meters (66-492 feet).  Wildlife habitat needs 30-500+ meters (98-1640 feet).

A 30-53’ established diverse buffer on a low slope area would likely fully or nearly fully address soil moisture retention, detrital input, filtering, and bank stabilization with half or more function of shade and half or slightly less function of LWD recruitment.  In short, it would significantly address many water quality functions and improve fish habitat, although not to full function for LWD recruitment and shade of larger streams.  Wildlife habitat would require a much larger buffer if it is a goal of the project.

Greater flexibility in buffer width (i.e., allowing a 35’ minimum buffer) would significantly improve riparian habitat in densely populated areas.  Presently, landowners of small parcels rarely enroll in CREP because wide buffer requirements take away a large percentage of their land.  In effect, the current wider buffer requirements result in no buffers on these types of parcels.  If minimum buffer widths were lowered, more private landowners in the agricultural-urban interface areas would be willing to restore riparian habitat, increasing the benefits to water quality and fish habitat.

Riparian restoration projects funded by other programs appear to have greater flexibility in buffer width.  For example, nearly all of the Salmon Recovery Funding Board (SRFB) approved riparian projects targeted the largest classification of streams (Type 1 or S), yet buffer widths ranged from 25 to 200 feet with the majority at 74 feet or less in width (PRISM database viewed Feb. 2006).

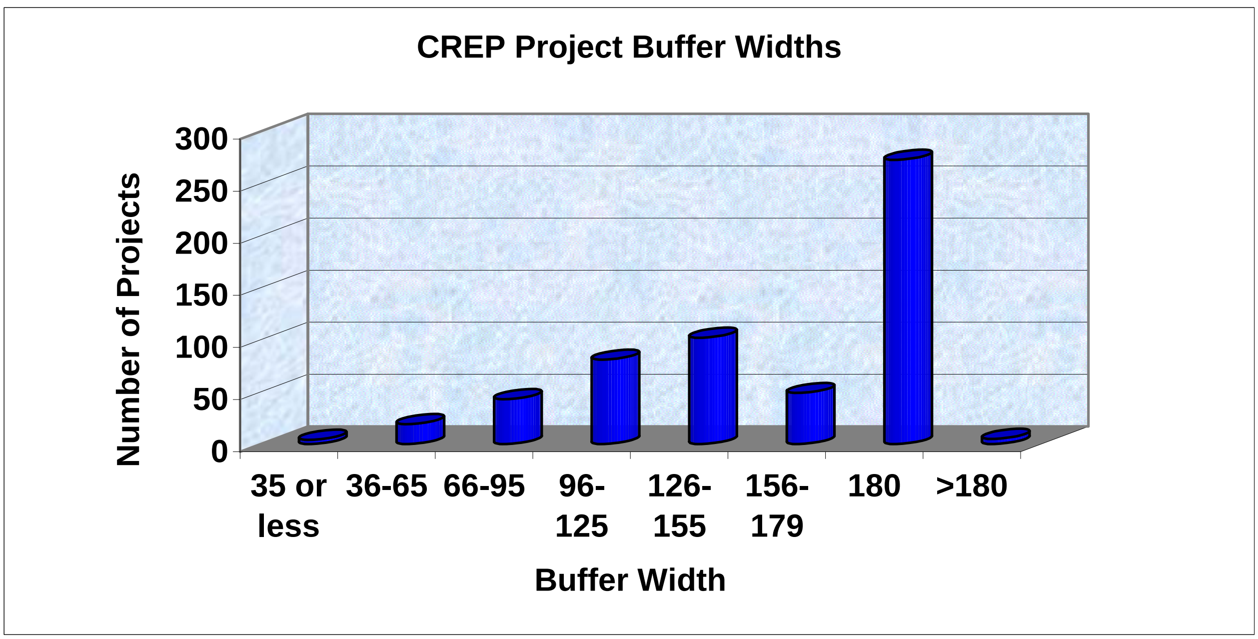
**CREP Benefits to Salmon and Watersheds**

Even though there are still many more stream miles that need riparian restoration in Washington State, the CREP projects are targeting the most important streams. Ninety-seven percent of the CREP projects are on streams identified by the state as “high benefit to fish” (Type 1 and 2 streams with most targeting Type 1). These are the largest streams in the state, and have high benefit to humans and wildlife as well. In addition, 73% of Washington CREP projects directly benefit watersheds that have known usage by ESA-listed salmon or steelhead. About half of the CREP projects benefit streams where two or more species of salmon and steelhead have been documented. If bull trout distribution were better known, the percentages of ESA and species number benefits would likely be higher.

Most of the current CREP buffers extend towards the maximum rental rate width of 180 feet. Forty-eight percent of the CREP projects have buffer widths of 180 feet or greater with only four percent of the buffers at 65 feet or less (Figure 2). The 180-foot buffers comprise one or more site potential tree heights in most areas, providing full riparian benefits for nearly all riparian functions.

Livestock exclusion is required for CREP projects in Washington State, and is one of the more important benefits to the program. When applicable, livestock exclusion adds to the cost by requiring fencing and off-site watering, but the benefits of natural regrowth are tremendous.

**Figure 2. Buffer widths of current CREP projects.**



## CREP Problems

Although the Washington CREP has been very successful at establishing healthy riparian buffers, the overall success of the program could be improved. Twenty three percent of the districts account for nearly 80% of the projects (CREP database, Whatcom Conservation District). Several changes have already occurred to increase participation such as hiring a person who manages CREP as their primary job duty and fully funding them by combining CREP programs from neighboring districts. However, there are problems that continue to limit the growth of the program. Some of these are technical, while others are process oriented. These problems are discussed in detail in the Discussion section of the following technical report with the most common problems outlined here.

- Rental rates are determined solely on soil. Additional participation is limited by rental rates that do not cover irrigation and taxes in portions of eastern Washington or are too low to compete with land values in parts of western Washington.
- Much of the bureaucratic process, including paperwork, is a great burden and extremely cumbersome.
- At least three different agencies are involved in the planning of each CREP project, and confusion has resulted regarding their respective roles with issues such as eligibility determinations and program guidelines.
- The program rules are constantly changing and the new rules change the program that has been promoted by districts. For example, the Signing Incentive Payment (SIP) has been reduced from $10/acre/contract year ($150/acre in most cases) to a cap of $100/acre regardless of contract years.
- Some projects have specialty situations that require additional approvals and currently, national level approval is required. This is seen as unnecessary and time consuming. A state or county level review makes more sense from not only a time perspective, but from knowledge of local conditions. Types of agriculture and watershed conditions are much better understood at the local level than at the national level.
- Parcel sizes are decreasing, especially in western Washington, and although the cumulative effect of riparian restoration of many such parcels can have a great benefit, most districts are unable to accommodate these types of CREP projects due to FSA buffer size restrictions, buffer width requirements, cumbersome paperwork, and low rental rates.
- The program is too constraining and inflexible regarding technical decisions in project planning.
- The most common technical problems faced by districts are animals and invasive plant species. Beaver are a large problem in some of the districts, but control can be done at a cost, and the options are provided in Appendix 1. Invasive plant species requires additional maintenance and costs.

## Recommendations

*CREP Renewal Recommendations*

The Conservation Reserve Enhancement Program has been highly successful in Washington State with high plant growth rates, excellent survival rates, and generally diverse buffers. The sites have overwhelmingly targeted the larger streams in the state that have high fish, wildlife, and human benefit. The majority of the sites are also addressing a major limiting factor (poor riparian conditions) for salmon and steelhead on the Endangered Species List. However, riparian conditions have been so extensively degraded, that there remains a continuing need for restoration. For these reasons, renewal of CREP is highly desirable.

During the renewal process, several changes should be sought to make the program more successful.

- Seek a way to incorporate a minimum 35' buffer regardless of floodplain option into the CREP program so that small parcels can be enrolled more easily. Currently, larger buffers take up a much greater percentage of these lands resulting in non-participation and no buffers at all. Programmatic guidance is needed clarifying that projects on small parcels are as important as large projects in restoring and protecting riparian buffers.
- Expand the eligible practices to potentially include wetland restoration, hedgerows, and grass filter strips, and other practices as developed by the CREP committee with input from FSA and resource agencies.
- Seek changes in the Washington CREP to include all types of agricultural lands in Washington, such as orchards, berries, and vineyards.
- Rental rates are still too low, and will be a larger problem in the future as more financial incentives will be needed to motivate remaining landowners. Soil alone should not determine rental rates. The current rates do not cover irrigation and taxes in some areas of eastern Washington. The current rates are also not competitive with developmental pressure in western Washington. Options should be explored in the CREP Committee.
- Reestablish the original SIP payment to $10/acre/contract year. This payment was intended to provide landowners with working capital to install best management practices (BMPs). Material costs have increased substantially since the program started and this incentive payment is even more important now.
- Increase caps for structural practices such as fence and water systems. Material costs for these BMPs have increased substantially since the hold-downs were established.
- Seek changes in next contract so that local (not national) committees can approve additional costs (ex. off-site watering).
- Examine the paperwork process and forms and try to simplify. Can the forms be electronic and linked so that information in common only be entered once? Can the paperwork burden to the landowner be reduced?

- Reinforce agency roles and oversight especially in areas that require technical expertise.

*Small Parcel Restoration Program Recommendations*

- Consider creating specific practices to address habitat restoration on small parcels.  Ideally, this program would have smaller minimum buffer requirements, such as 35’ minimum buffers regardless of floodplain, simpler paperwork, and be state-funded to reduce federal paperwork and approval processes.  These types of parcels are becoming more common as development pressure increases, and without such a program, conservation and restoration will likely not occur on these lands.
- If such a program cannot be developed solely within state government, consider negotiating these components into the CREP renewal process.

# Introduction

## Riparian Function

Riparian areas include the land adjacent to streams, rivers, and nearshore environments, and serve as the interface between the aquatic and terrestrial environments. These zones are normally covered with grasses and forbs to shrubs and large trees depending upon the ecoregion type. Riparian habitat begins at the ordinary high water line and extends to that part of the terrestrial landscape that directly influences the aquatic ecosystem through shade, large woody debris (LWD), nutrients, organic and inorganic debris, or terrestrial insects. It includes the entire extent of the floodplain because that area interacts with the stream system during flood events. The riparian habitat area also encompasses the entire extent of vegetation adapted to wet conditions.

The type of vegetation within the riparian zone is crucial, as different types of vegetation have different functions. Tree and shrub roots hold streambanks together, stabilizing channels, decreasing erosion, and creating fish habitat (Bjornn and Reiser 1991, Montgomery and Buffington 2001). Overhanging trees shade water, maintaining cool water temperatures and contributing leaf litter, which serves as food for the organisms that in turn provide food for fish (Bjornn and Reiser 1991, Bisson and Bilby 2001, Naiman et al*.* 2001). Mature trees in the riparian zone also provide important functions when they fall into streams to become large woody debris (LWD) because LWD stabilizes streambeds and banks, holds spawning gravels, creates pools that provide resting areas for salmonids (Bilby and Bisson 2001). Grasses in the riparian zone filter pollutants from soil and aid in bank stability and sediment trapping (Knutson and Naef 1997, Welch et al*.* 2001, Fischer and Fischenich 2000). Invasive species such as reed canary grass and Himalayan blackberry are not effective at most riparian functions, and their rapid growth often replaces the native, functional plants that comprise a healthy riparian zone.

Riparian zones are impacted by all types of land use practices, some of which include direct removal of riparian vegetation, roads and dikes located adjacent to the stream channel, unrestricted livestock grazing in the riparian zone, loss of riparian from landslides and other sedimentation and flooding impacts, and development in the riparian corridor. Further, riparian vegetation species composition can be dramatically altered when native trees are replaced by exotic species (e.g., Japanese knotweed, reed canary grass), and where native coniferous riparian areas are converted to deciduous tree species. Deciduous trees have generally smaller diameters than conifers and when they fall into streams to form LWD, they decompose faster than conifers and are vulnerable to being washed out by lower magnitude floods. Once impacted, riparian functions can take many decades to recover as forest cover regrows and coniferous species colonize. It may take as long as 80 to120 years to restore functional LWD to the channel.

## Agriculture

Washington State ranks 6th in the nation for the value of crops, and agriculture is Washington State's largest employer, contributing about 20% of the state's gross production (Canty and Wiley 2004). Agriculture covers 21% of the land area in the state with coniferous forest covering 37% and urban lands comprising 2.5% (Cassidy et al. 1997). However, there are distinct differences in agricultural activities and natural riparian conditions between eastern and western Washington.

Agriculture and grazing/rangeland comprise the greatest land use in eastern Washington by area (Hashim 2002). In northcentral Washington, grazing accounts for 71% of the Foster Creek Basin and 52% of the Okanogan drainage (Hashim 2002). Land use is predominantly agriculture and grazing with lesser amounts of forestry in the Blue Mountains region as well. Range is important in the Naches, Upper Yakima, Entiat, Chelan, and Methow basins. Yakima County ranks fifth in the nation for total agricultural production (Haring 2001), and the soil of the Palouse Prairie consists of loess, and is one of the most fertile areas of the country (Bailey 1994).

In western Washington, agricultural activities are more limited, primarily located along river valleys or are concentrated in the lowlands of certain counties. In the north Puget Sound basins of Skagit, Island, Nooksack, and San Juan, there is significant agricultural land use consisting of 22, 15, 15, and 13% respectively (Hashim 2002), but forestry is the predominant land use throughout much of western Washington. For example, forestry comprises 60% or more of the land area in the Upper Skagit, Stillaguamish, and Snohomish basins (Hashim 2002).

While King, Pierce, Thurston, and Snohomish counties have a mix of agriculture and forestry land use, urbanization dominates their lowlands. Washington ranks 20th in the nation in size and 15th in human population with ¾ of the State's population located in the Puget Lowlands (U.S. Census Bureau 2000). Historically, most of this region was covered with conifer forests. Currently, the Douglas fir zone of the Puget Lowlands consists of only 15% conifer land cover with 25% urban and 19% agricultural lands (Cassidy et al. 1997).

Forestry is also the major land use throughout the remainder of western Washington. In southwest Washington, agriculture covers 11% of the upper Chehalis drainage, but only 1 to 5% of the lower Chehalis and Willapa basins (Hashim 2002). To the east (Cowlitz, Lewis, Salmon, Washougal basins), land use consists of forestry (62%) with 14% in urban lands and 15% in agriculture. This area also has a high human population density (U.S. Census Bureau 2000).

To summarize, agriculture is generally the most predominant land use type in many eastern Washington basins, while it is the second most common land use based upon acres of land in western Washington. Agriculture is more frequently located along streams and in the lower portions of watersheds, where historically, the most productive salmon habitat once occurred (Beechie et al. 2001). Taken together, watershed and salmon restoration depend upon habitat conditions on agriculture lands.

### CREP Background

In Washington State, about 37% of salmon streams pass through private land used for agriculture (NMFS and USFWS 2000). Because much of the agricultural land is located in or near historic floodplain-rich habitat, it is important to continue to develop opportunities to not only improve riparian habitat for healthy watersheds, but also to maintain viable agriculture. Once land is converted to more intensive development (urban and industrial), the prospects to preserve or restore habitat near streams greatly decrease, and environmental impacts increase. Between 1982 and 1997, about 20% of the farmland in the Puget Sound region was lost to other uses, especially in King and Snohomish Counties where urban growth has been high (Canty and Wiley 2004).

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- Reduce water temperatures to natural ambient conditions.
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- Stabilize streambanks.
- Restore 10,000 miles of stream condition in Washington State.

Since the program began in Washington State, there have been 576-signed contracts, 9565 acres of riparian buffer planted at an average width of 150 feet, and spanning a length of 553 miles (Debbie Becker, Conservation Commission, personal communication). Because habitat values increase when fragmentation is reduced, projects that are contiguous to one another are greatly desired. Since 1999, 329 of the 576 contracts are contiguous with other CREP projects. However it should be noted that many more CREP projects are also contiguous with restoration projects implemented under other programs. For example the Nooksack Salmon Enhancement Association has been restoring stream buffers for over 20 years in Whatcom County.

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$1,008,045 are paid each year to landowners by the U.S.D.A. as a rental payment for the protected buffer.

Flexibility of this program is vital to adapt to different landowners needs, while providing the majority of riparian functions. One example is the recent change of buffer widths to range from 35 to 180 feet. The current minimum buffer width is the larger of 35 feet or 30 percent of the active floodplain (U.S.D.A. 2004).

## Purpose of Project

The purpose of this project is to evaluate the current status of riparian buffers developed under the CREP program in Washington State. How successful has the program been and what actions are needed to increase its success in the future?

## Methodology

Since the onset of the CREP program in 1998, there have been 576 contracts signed. The following data were collected and analyzed for most of these contracts and stored in an Excel spreadsheet. Not all information was available for all contracts.

- Stream Name
- Stream Type 1 or 2 (large stream)
- Small Stream (not 1 or 2)
- Buffer Length
- Buffer Width
- Buffer Acres
- Total Seedlings Planted
- Seedlings/Acre
- Restoration Cost
- Annual Rental Payment
- Project Implementation Date
- CD Contact Person
- Number of Salmonid Species Benefited
- ESA Listed Species Benefited
- Problems Encountered
- Solutions Used
- Notes: unsuccessful vs. successful solutions

Data regarding salmonid species and usage were obtained from the maps in the salmon habitat limiting factors reports. Stream type data were obtained from a GIS layer from the Department of Natural Resources. Data existed within an Access database at Whatcom Conservation District for many of these data fields.

Each conservation district was contacted to collect the remaining data, such as WRIA, stream name, problems encountered, and solutions used.

In addition, 50 sites were randomly selected for field measurements. Randomization was accomplished using the Research Randomizer (2005). For these sites, the following data were collected:

- Number of CREP plants per grid by species
- Beginning vegetation height by species
- Current vegetation height by species
- CREP plant mortality
- Replant data, and
- Thinning data

The field measurements occurred in randomly selected 900 $ft^2$ grids, except a few sites were shaped such that the grids needed modifications.

Specific questions this project answered:

- What are the growth rates of CREP plants by plant type and by site?
- What are the percent survival estimates of CREP plants by site?
- What is the density of plants, and has thinning or replanting occurred?
- What is the estimate of plant diversity by district and region?
- How many CREP projects address large stream reaches (Type 1, 2) versus smaller streams?
- How many CREP projects benefit multiple salmon or steelhead species?
- How many projects benefit an ESA listed salmon or steelhead species?
- What problems have been encountered?
- What solutions have been used either successfully or unsuccessfully for these problems?
- What suggestions do districts have to improve the program?

# Results

## Plant Growth

In eastern Washington, overall CREP plant growth was variable with an average of 13.2 inches per growing season (Figure 3). Conifers grew an average of 10.1 inches while shrubs and deciduous plants grew 14.5 inches per growing season (Figure 3). The variation from site to site is more apparent when looking at the medians of growth data for eastern Washington, particularly for conifer growth (Figure 4).

Western Washington sites had less variability in growth and were not significantly different in overall growth or conifer growth compared to eastern Washington with average rates of 18 inches for all CREP plant growth and 13.6 inches per growing season for conifer growth (Figure 3). Student's t-test p values were 0.36 for overall growth between the two regions and 0.48 for conifer growth. The Student's t-test shows statistical differences between the averages of different groups. P values of 0.05 or less usually show that there are real differences between groups. Values higher than 0.05 are considered not significantly different, but could be a result of small sample sizes.

Deciduous and shrub growth was significantly greater in western Washington with a mean of 23.5 inches per growing season and a p value of 0.05 when compared to eastern Washington growth. Deciduous growth was significantly higher than conifer growth in western Washington with a p value of 0.0017.

All of the sites were six years or less in age with an average of 3.5 years. There was no relationship between growth/year and number of growing seasons for the sampled sites using correlation analysis.

**Figure 3. Mean CREP plant growth per growing season with 95% confidence limits.**

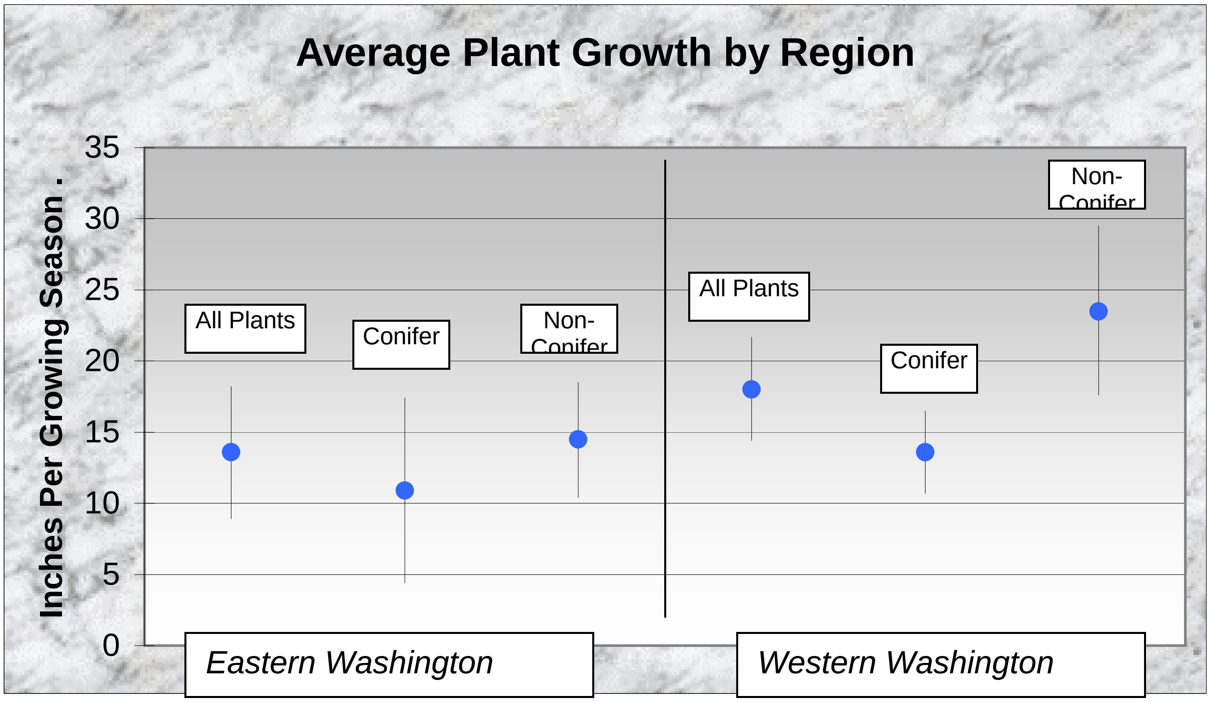
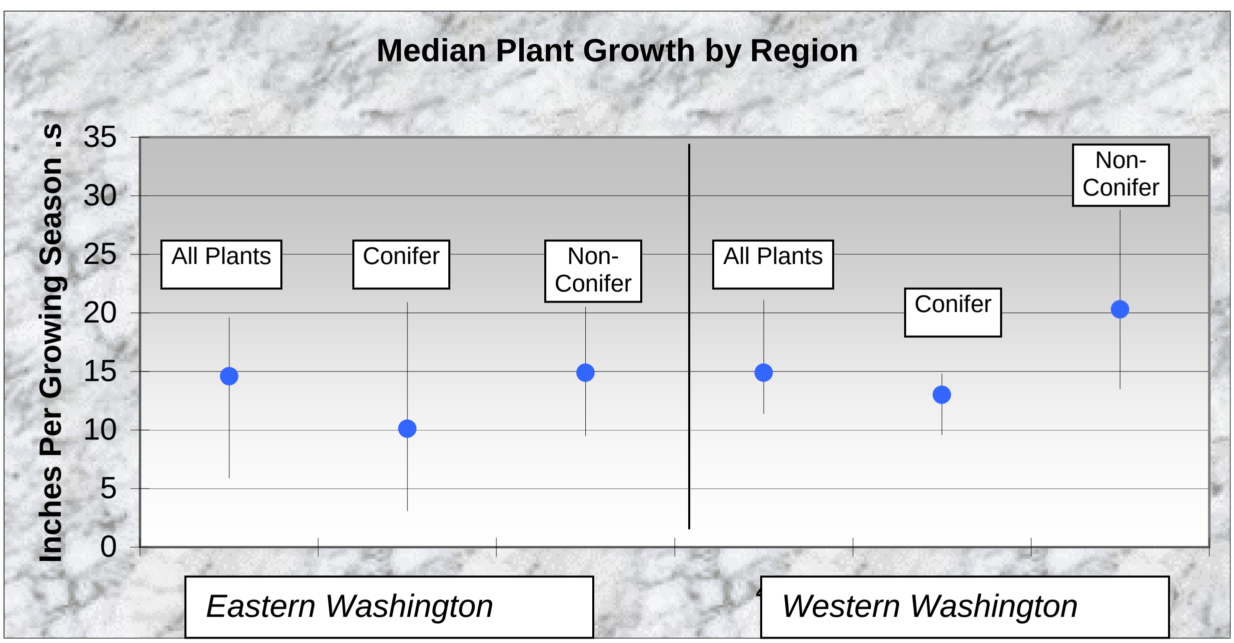



**Figure 4. Median CREP plant growth per growing season with 95% confidence limits.**



**Plant Diversity**

Diversity of planted stocks was relatively low in the sampled eastern Washington sites. This can be attributed to the fact that most sites are on marginal pastureland and have an existing riparian area. The species planted were prescribed to add diversity to the established species. The exception was in Walla Walla where the majority of contracts were previously cropland (Figure 5). A higher diversity of species was successfully established. Although located in an area of very low precipitation levels, Walla Walla was able to maintain excellent diversity, survival, and growth because they used a woven polypropylene mulch called Lumite 300 around their CREP plants. However, the cost of purchasing and installing the mulch is daunting for many districts (the FSA limit for mulch is $1.50 per lineal foot). Also, the rocky soils of some of the higher gradient sites are not suitable for this type of buffer. Some of the other eastern Washington districts used willows as their non-conifer component. These had excellent survival and growth statistics although species richness was reduced.

Plant species diversity at western Washington sites was much higher with an average of 6.8 species per site per district (Figure 6). Less harsh environmental conditions coupled with high precipitation levels are likely factors that contribute to the ability to maintain a greater number of plant species. The plant diversity estimates in this assessment are likely underestimates because the sites were sampled. It is likely that a complete inventory would have generated higher diversity estimates. Also, only CREP planted species were included, not existing species, which would also underestimate true plant diversity. However, most sites restored open land, and did not have many existing trees or native shrubs.

**Figure 5. Number of different species planted at CREP sites in eastern Washington by conservation district.**

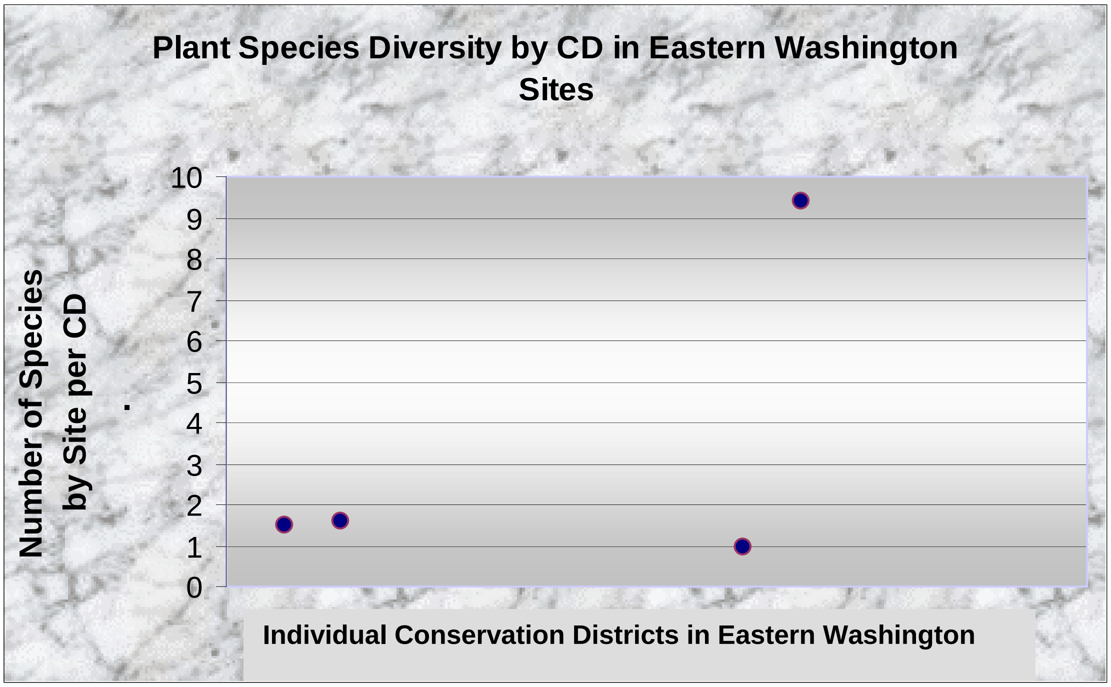
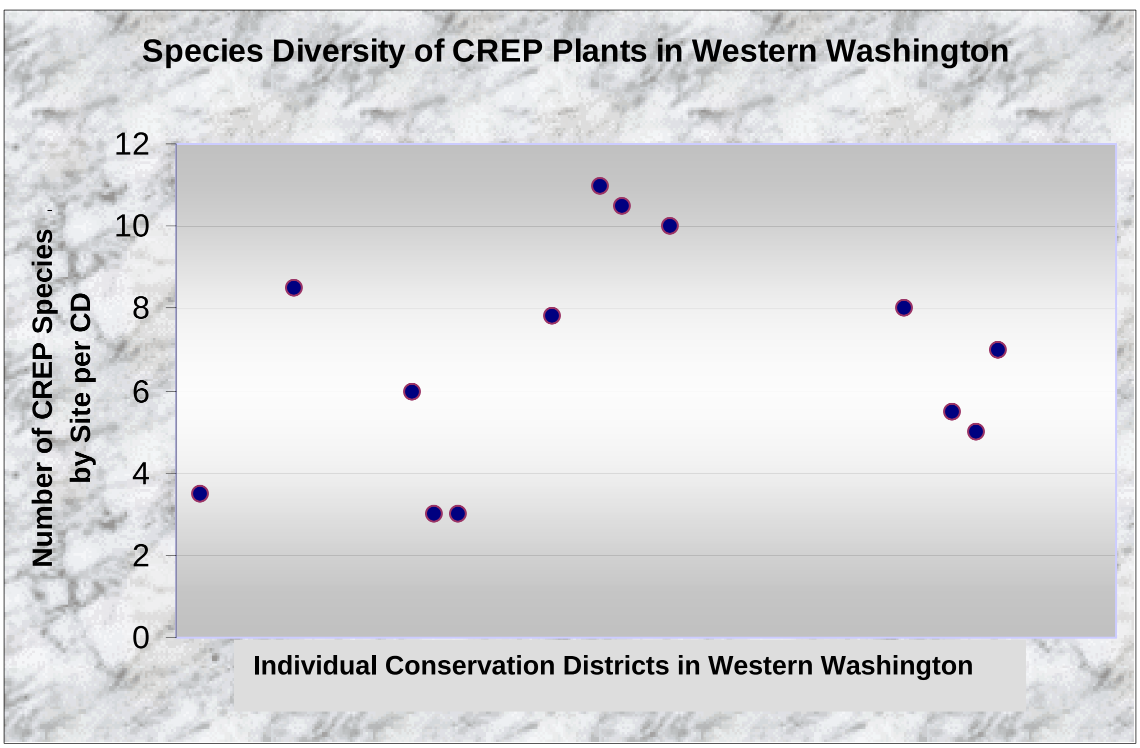



**Figure 6. Number of different species planted at CREP sites in western Washington by conservation district.**



## Plant Survival

In general, the survival of trees and shrubs planted under CREP contracts was excellent. The average percent survival in sampled eastern Washington sites was 77 with a median percent survival of 95 (Figure 7). Two sites had no survival due to consecutive years of drought combined with the inability to water the CREP plantings.

At sampled western Washington sites, the average percent survival of CREP plants was 87.5 and the median percent survival was 92.6 (Figure 8). While no sampled sites in western Washington suffered a catastrophic loss, more sampled western Washington sites had generally but not statistically significant ($p=0.13$) lower percent survival ratings compared to eastern Washington.

A few assumptions were made when estimating percent survival. If replants were present, it was assumed that they replaced a mortality, so although the dead plant was not directly observed, one was counted for each replant. At a few sites, replants were difficult to distinguish from original plantings, and increased error in identification could result in an estimated higher survival rate compared to actual (plants were not recorded as replants unless a high degree of confidence existed regarding their status as replants). In the few sites that interplanted CREP plants among established trees, mortalities might have been missed if no dead plant material was found because the CREP plants would not have been placed in a grid formation where missing plants would be more obvious. This could also increase the estimated percent survival compared to actual. Lastly, if missing plants in a grid formation existed, it was assumed they were mortalities. If this assumption is incorrect, it would result in an estimated percent survival that is lower than actual. Two sites were not included in the analysis because of great uncertainty regarding the identity of replants and past mortalities.

**Figure 7. Percent survival of CREP plants at sampled sites in eastern Washington. The blue line represents the mean. Each dot represents a CREP contract site.**

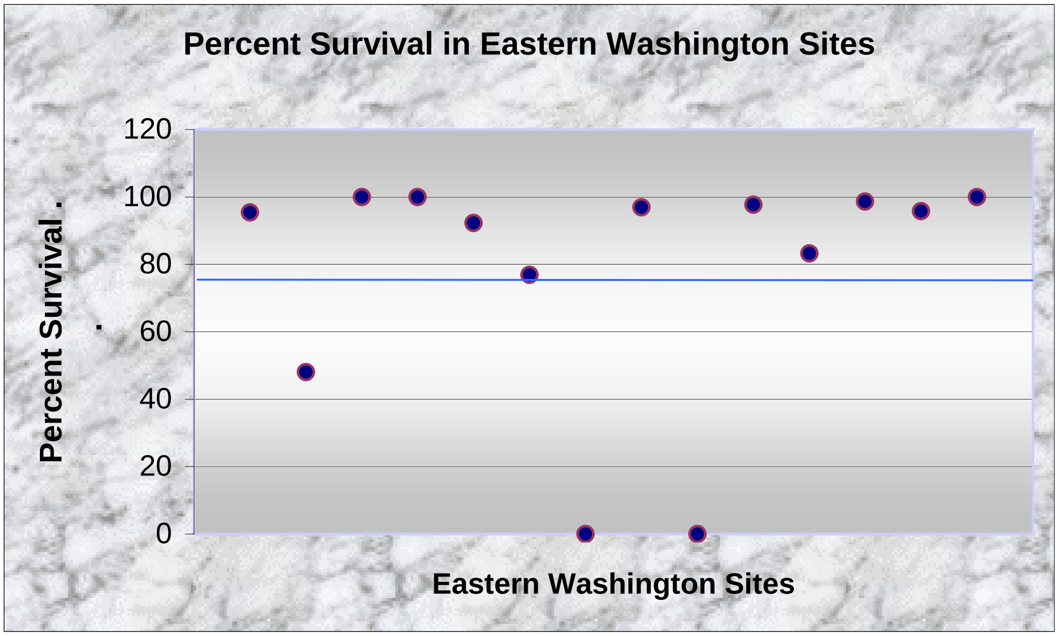
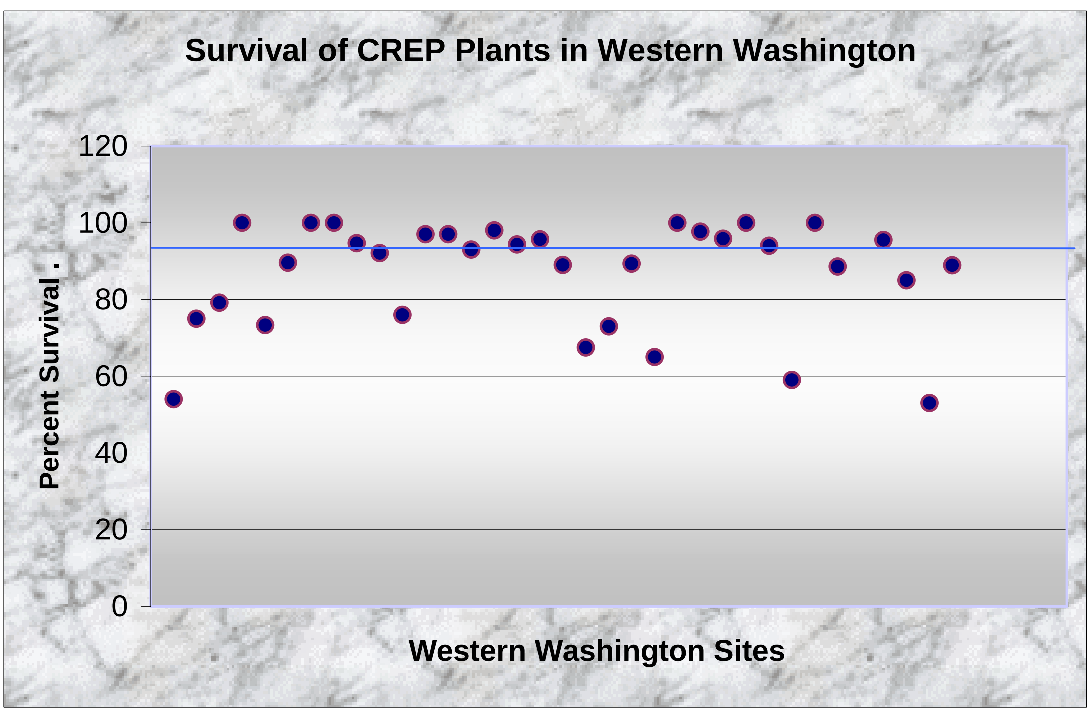



**Figure 8. Percent survival of CREP plants at sampled sites in western Washington. The blue line represents the mean. Each dot represents a CREP contract site.**



### Plant Density

The density of all live plants (planted under CREP contracts) in eastern Washington averaged 861 per acre with a median value of 518 per acre (Figure 9). The high-density sites contain willows. If only conifers are examined, the mean density is 78 trees per acre with a median of 36 (Figure 10). Conifer presence is naturally low in these areas. Most of the sampled sites were in arid regions that were historically dominated by grasses and shrub-steppe vegetation, and riparian trees were primarily deciduous species, such as willow, alder, cottonwood, and birch (Meinig 1968, Mudd 1975, and Saul et. al. 2000 cited in Kuttel 2001; Kuttel 2002). For these reasons, the density levels in the sampled eastern Washington sites appear to be within expectations.

Eastern Washington CREP plant survival was correlated with density such that the rs statistic for a Spearman rank correlation was 0.75 with a p value of 0.0031. This indicates that plant density is likely higher because of increased survival rather than overstocking.

**Figure 9. Density of all live CREP plants at sampled eastern Washington sites. The blue line denotes the median value.**

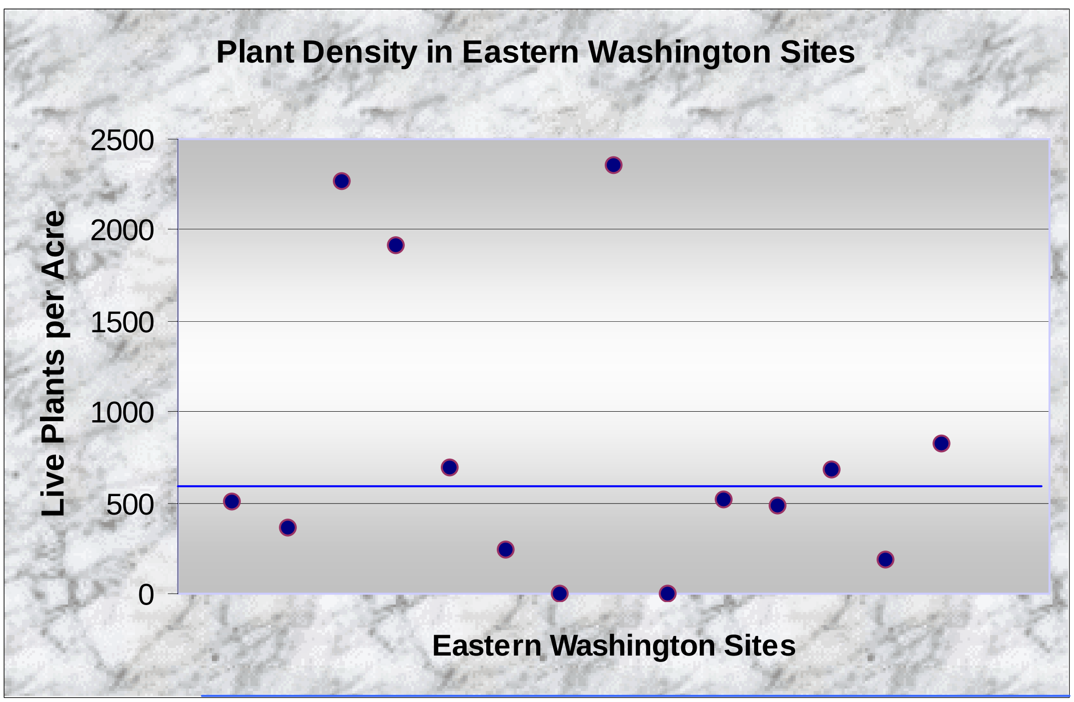
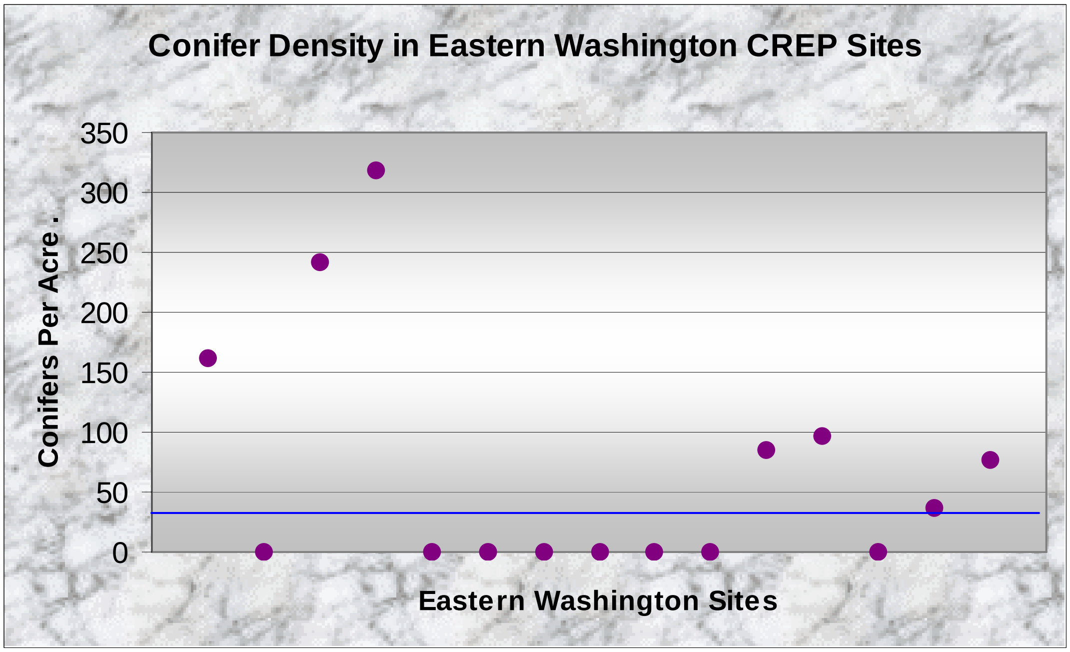


**Figure 10. Density of live conifer CREP plants at sampled eastern Washington sites. The blue line denotes the median value.**




In western Washington, the average number of live CREP plants per acre was 958 with a median of 610 (Figure 11). One site is not shown in the figure as it had 9975 plants per acre (willows) and did not fit the scale of the chart. The mean and median include this site, and it should be noted that only one of the several grids sampled at this site contained willows, but they were so dense that their numbers skewed the mean at that site. Conifers are naturally an important component of western Washington riparian buffers, and when examined separately comprise a mean of 380 trees per acre with a median of 323 (Figure 12).

**Figure 11. Density of live CREP plants at sampled western Washington sites. The blue line denotes the median value. One value of 9975 is not shown on the graph.**

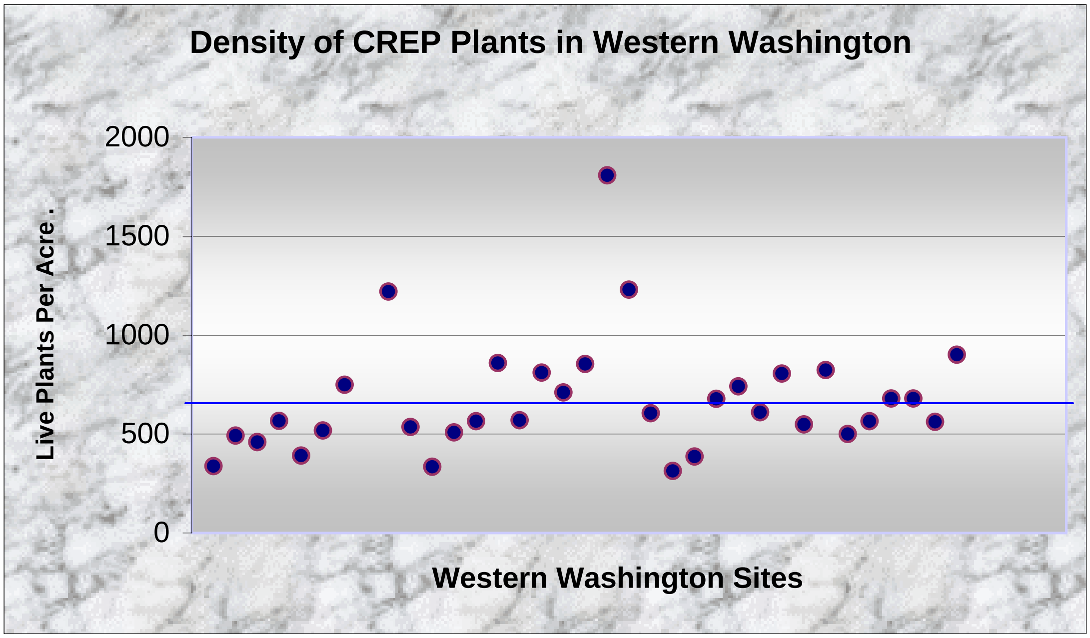
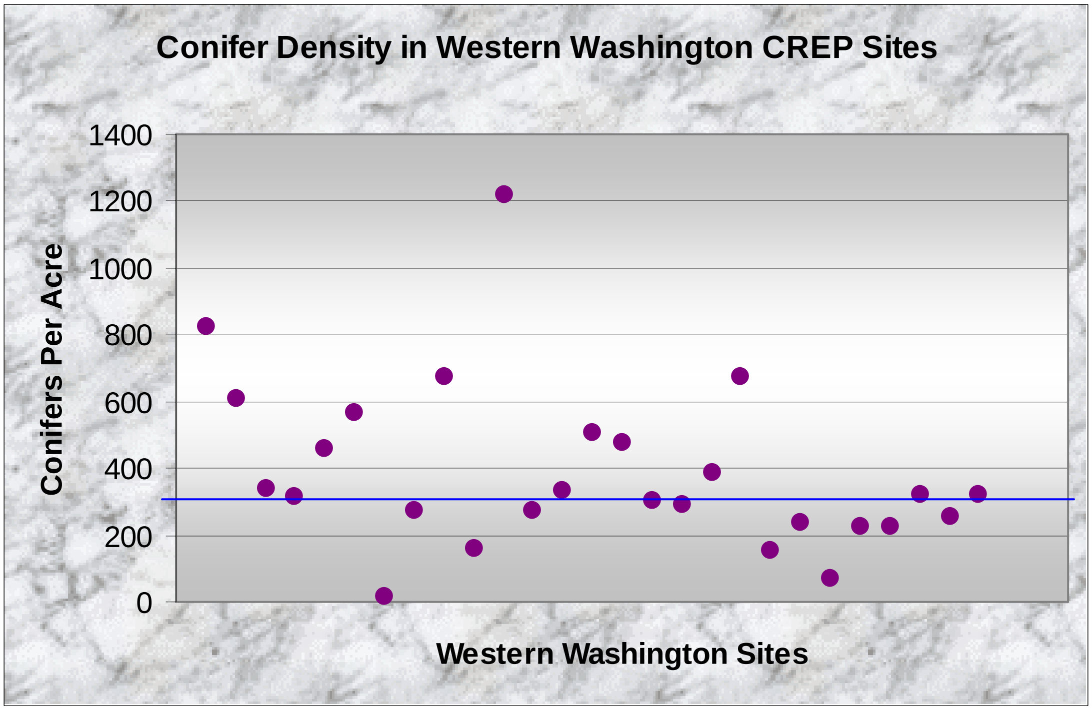


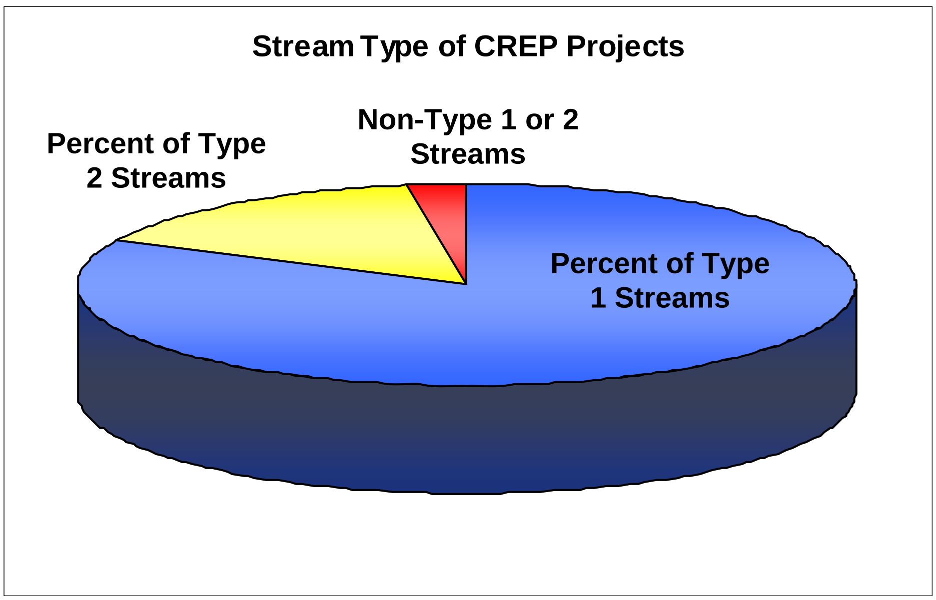

**Figure 12. Density of live conifer CREP plants at sampled western Washington sites. The blue line denotes the median value.**



### Watershed and Salmonid Benefit of CREP Projects

Of 576 CREP projects, 464 had stream type information available. Of these, about 82% of the CREP projects border the largest streams (Type 1) in the state (Figure 13). Type 1 streams, which are also S streams in WAC 222-16-030, are specifically defined as "all waters within their ordinary high water marks that have been inventoried as "shorelines of the state" under chapter 90.58 RCW (Shoreline Management Act)". Another 15% of CREP projects border Type 2 streams, which are defined as "segments of natural waters which are not classified as Type 1 water and have a high fish, wildlife or human use" (DNR 1996). Only 3% of CREP projects with stream type data border small streams that have a fish, wildlife, or human use value that is moderate or less.

**Figure 13. Stream types that Washington State CREP projects border.**




Most (73%) of the CREP projects in Washington State were located in watersheds that have ESA listed salmon or steelhead stocks (Figure 14). Regardless of ESA status, 39% of CREP projects were in watersheds that had three or more species of salmon and steelhead, while 21% were located in watersheds with two species and 40% in drainages with one salmon or steelhead species (Figure 15).

**Figure 14. ESA-listed fish species that benefit from Washington State CREP projects.**

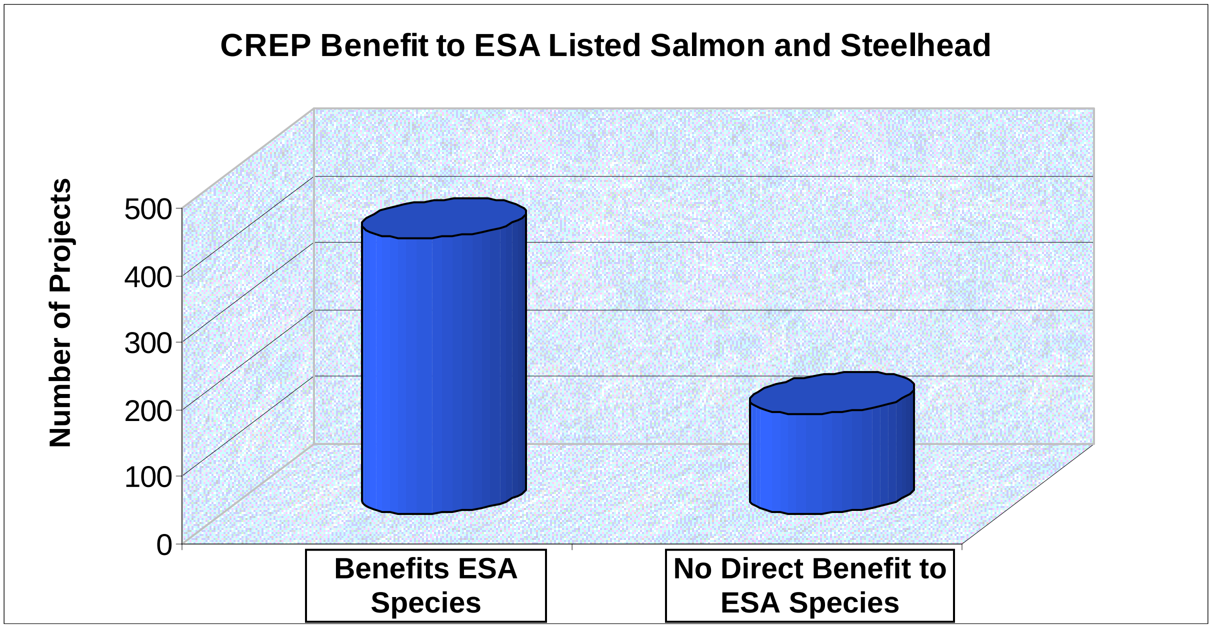
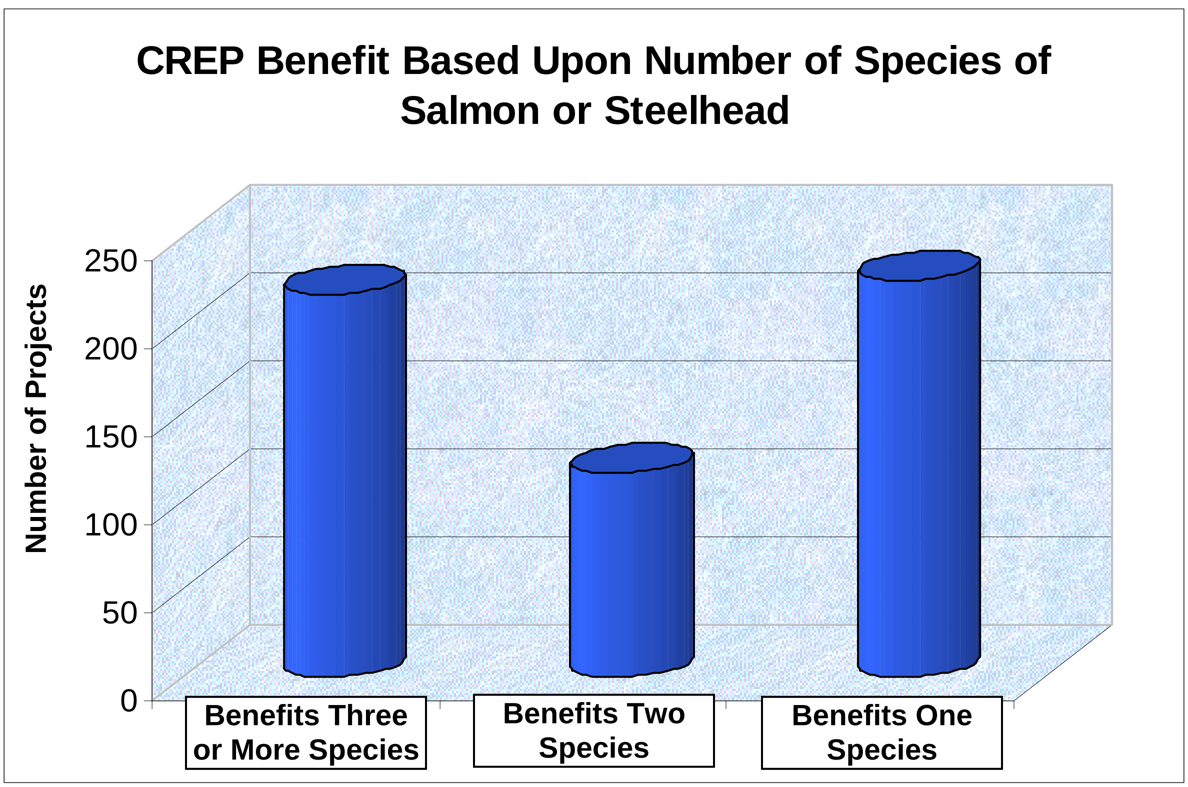
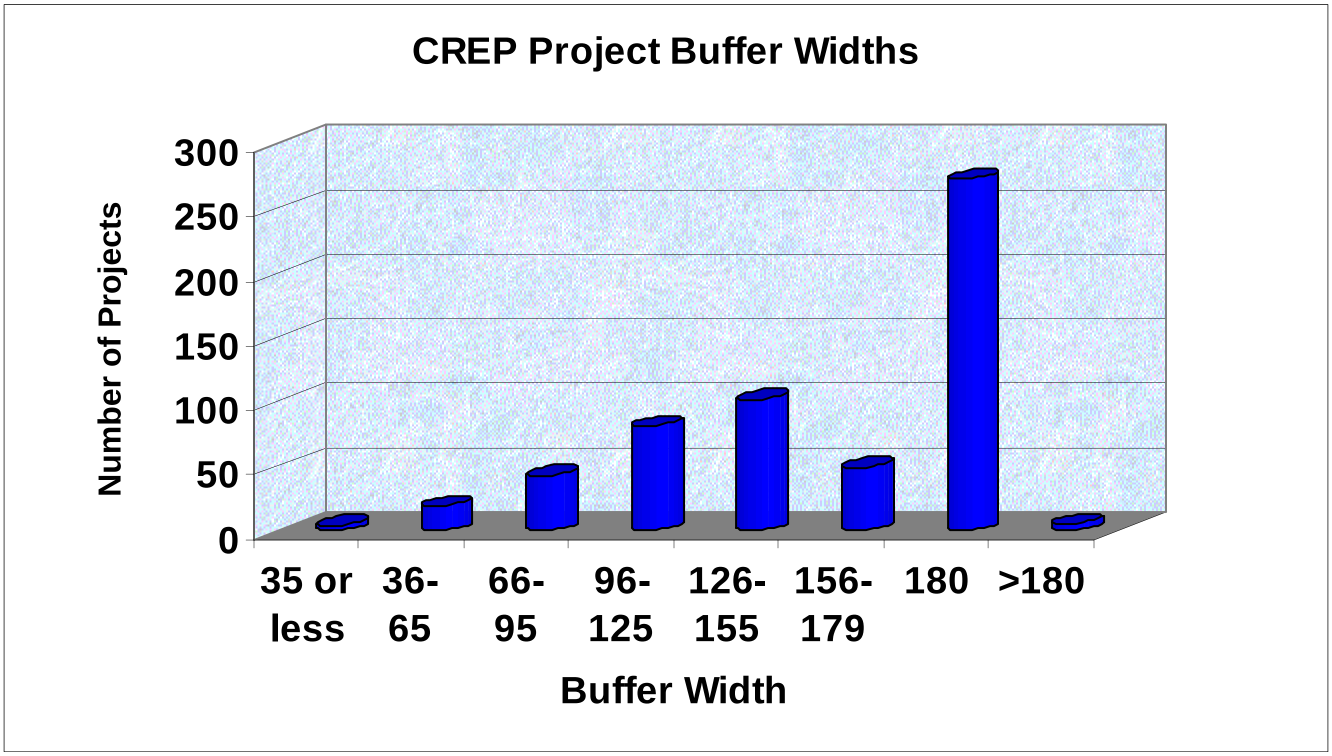



**Figure 15. The number of CREP projects based upon location to number of species of salmon or steelhead in Washington State.**



Most of the current CREP buffers extend towards the maximum rental rate width of 180 feet. Forty-eight percent of the CREP projects have buffer widths of 180 feet or greater with only four percent of the buffers at 65 feet or less (Figure 16). These widths would comprise one or more site potential tree heights in most areas, providing full riparian benefits for nearly all riparian functions (Table 1).

**Figure 16. Buffer widths of current CREP projects.**




Livestock exclusion is required for CREP projects in Washington State, and is one of the more important benefits to the program. When applicable, livestock exclusion adds to the cost, requiring fencing and off-site watering, but the benefits of natural regrowth are tremendous. Figures 17 and 18 show sites in Columbia County where fence lines clearly indicate the difference between lands excluded from livestock next to lands that allow livestock.

**Figure 17. Natural revegetation in Columbia County. The fence line separates an area of livestock access from livestock exclusion.**

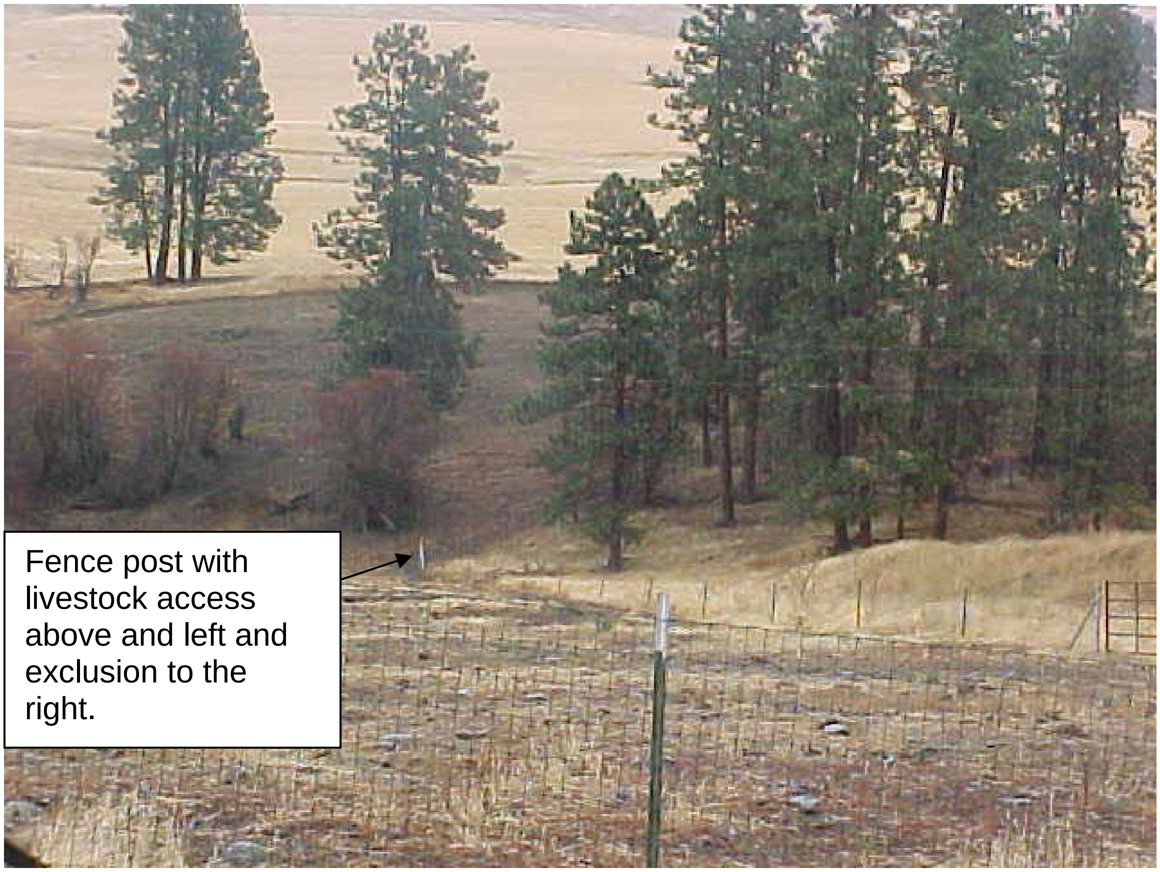


**Figure 18. Natural revegetation in Columbia County. The fence line separates an area of livestock access from livestock exclusion.**


## CREP Project Costs

Riparian restoration costs average $2,672 per acre across 576 projects in Washington State. There was uncertainty with some of the values though as projects varied in whether funds from other sources were included or not. A few districts had higher costs than average and the reasons include extra site preparation, using container grown plants and higher planting costs in areas where small parcels are common and the district is unable to hire a forestry contractor to plant trees. Other reason was the use of mulch, which costs $1.50 per linear foot based upon a six foot width, but pays off later by reduced weeding and increased survival, especially in areas where drought is common, and irrigation would result in greatly increased costs. Off-site watering of livestock to exclude them from the riparian zone also contributes to higher costs but provides many other benefits to the watershed.

The average rental payment for CREP projects in Washington State is $166 per acre per year (Rod Hamilton, FSA, personal communication). Very low rental rates (average of $86.18 per acre/year) exist in the Okanogan District with other relatively low rates in parts of eastern Washington. The rental rates are set by the Farm Service Agency and are 200% of the weighted average soil rental rate with an extra incentive of 10% of the average soil rental rate for agricultural land of state significance" under Washington's Growth Management Act (Whatcom Conservation District 2006).

**CREP Project Activity**

Whatcom and Walla Walla conservation districts have the most CREP projects based upon contract numbers, followed by high participation in Skagit, Columbia, Pomeroy, Asotin, Lewis, Snohomish, and Jefferson districts (Figures 19 and 20).

When the amount of acreage in CREP contracts is examined across the state, Walla Walla has by far the most acreage at 2443 acres (Figures 21 and 22). Columbia, Whatcom, Asotin, and Pomeroy also have very high acreage quantities, followed by Skagit, Lewis, Snohomish, Yakima, Wahkiakum, Jefferson, and Pacific districts.

**Figure 19. Number of CREP contracts by conservation districts in eastern Washington.**

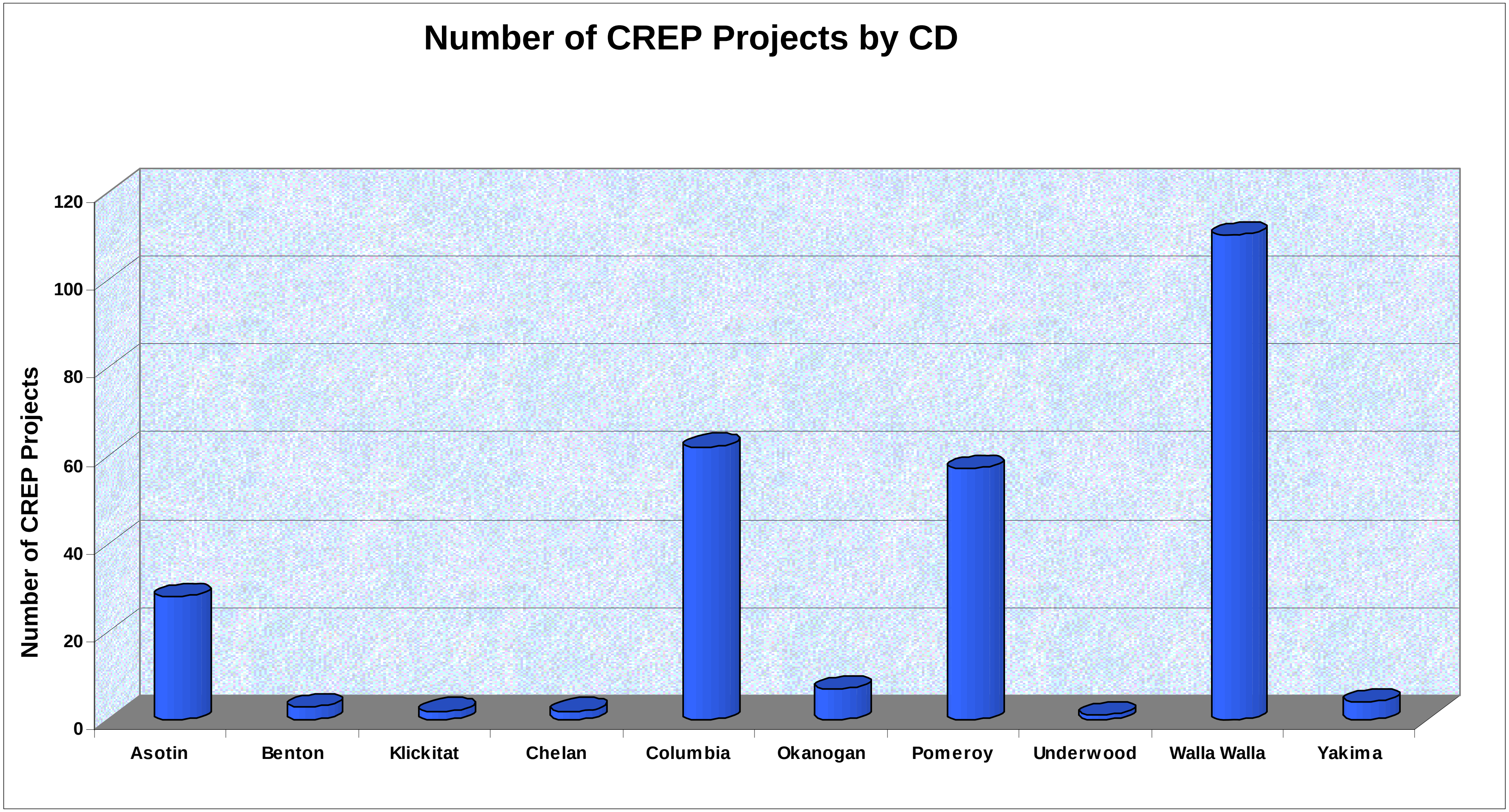


**Figure 20. Number of CREP contracts by conservation districts in western Washington.**

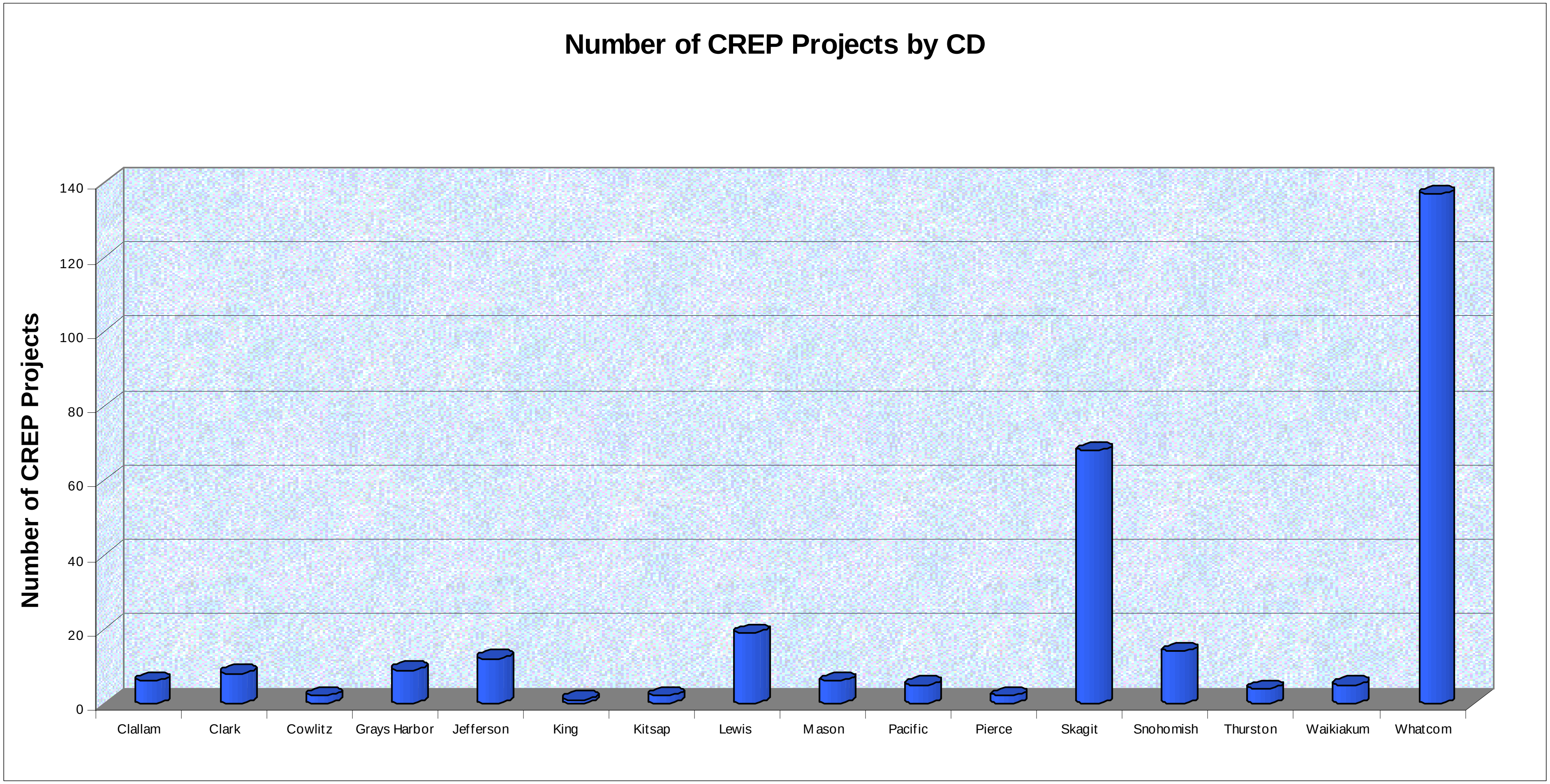


**Figure 21. Total acres of riparian buffer in CREP contracts in eastern Washington.**

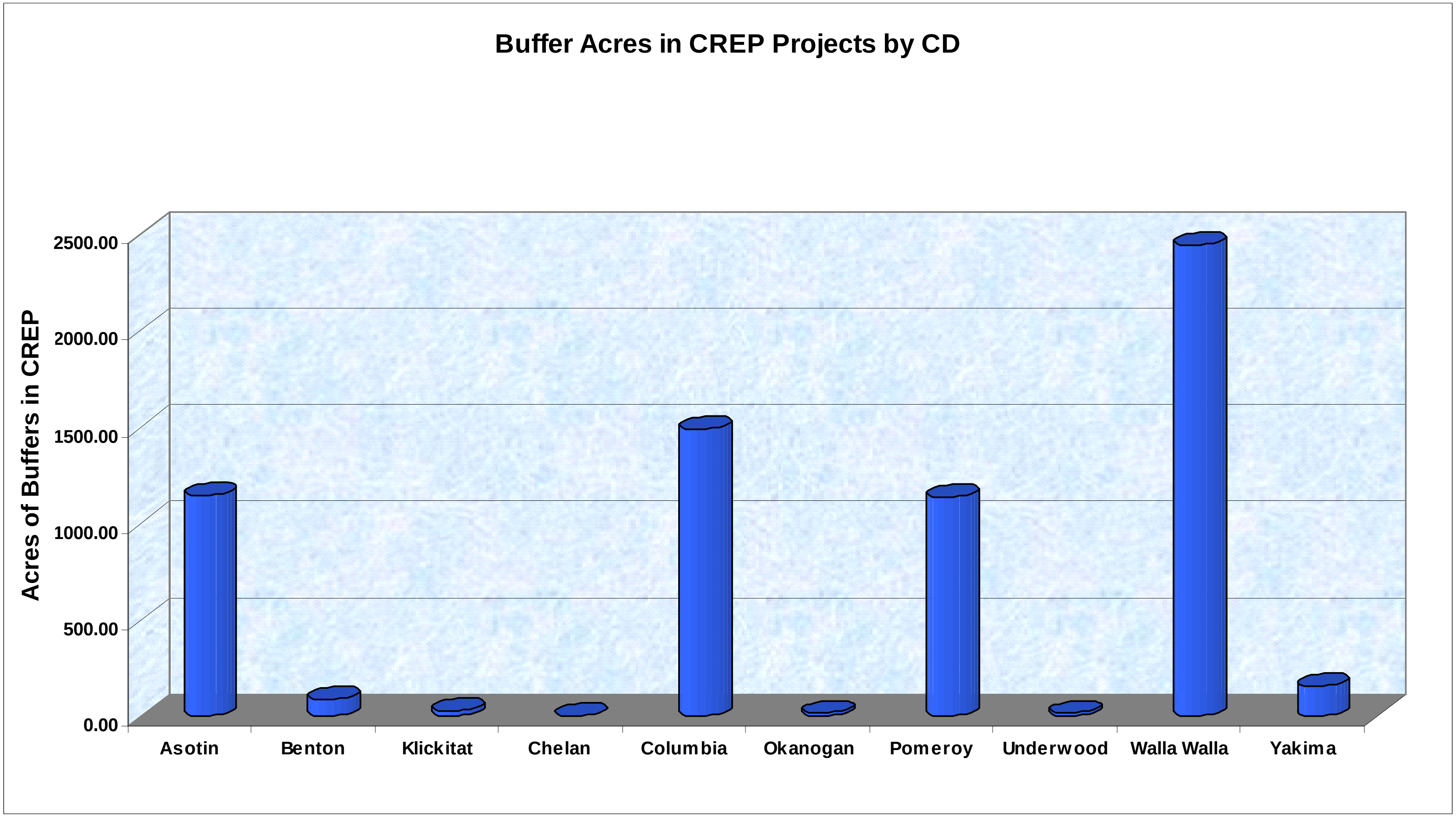
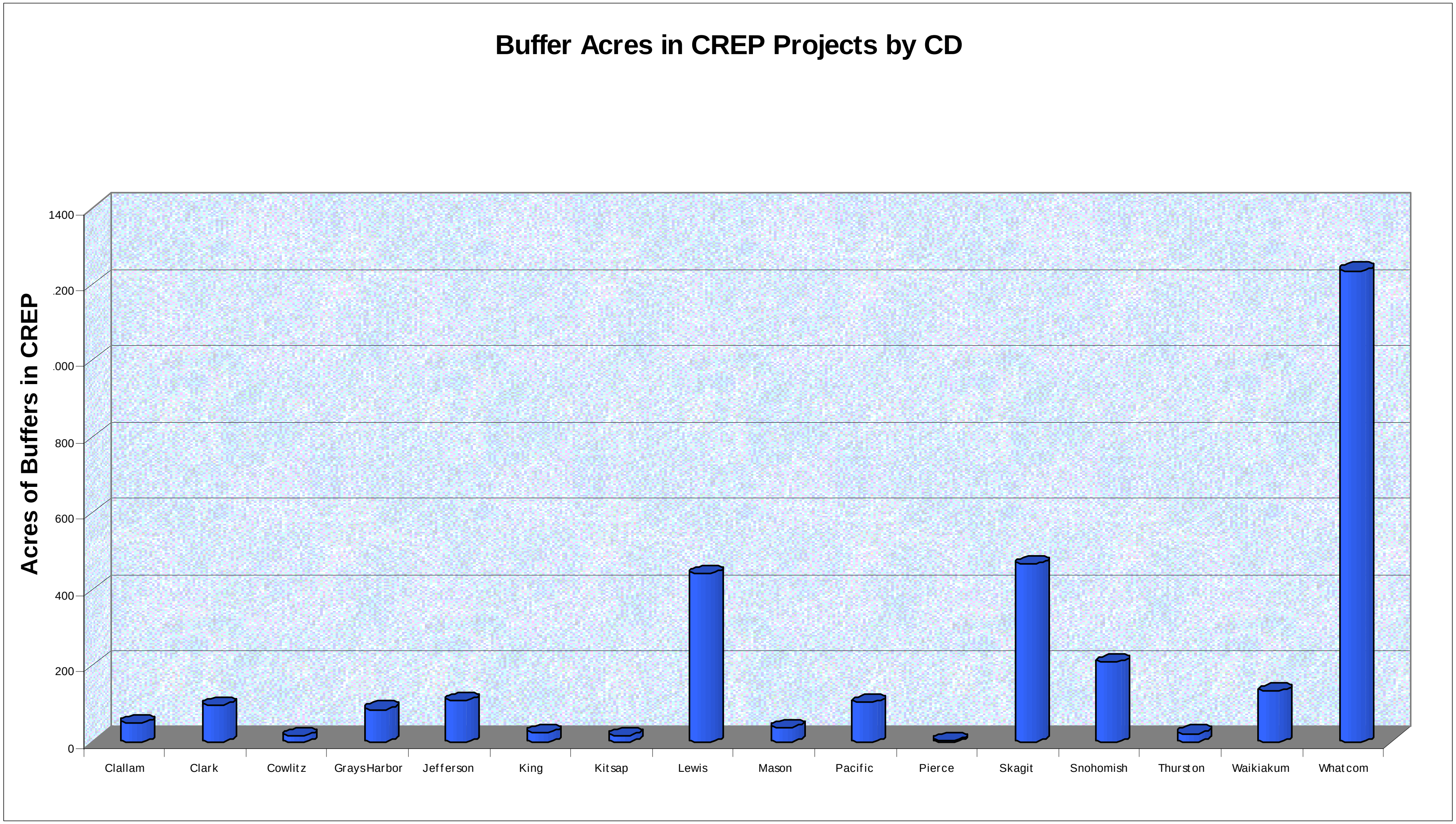


**Figure 22. Total acres of riparian buffer in CREP contracts in western Washington.**



# Discussion

## Riparian Conditions in Washington State

Natural riparian conditions vary according to climate, geology, stream type, hydrology, and topography. Generally, there are three major types of riparian communities in Washington State, the forested areas of eastern Washington, the arid regions of eastern Washington, and forested western Washington. In the forested areas of eastern Washington, native riparian vegetation can include cedar, western hemlock, big leaf maple, quaking aspen, water birch, and other deciduous trees with Douglas fir, paper birch, black cottonwood, and quaking aspen found along streams located in the ponderosa pine regions. Shrubs and perennials in these riparian zones include willow, Oregon boxwood, red-osier dogwood, mountain alder, ninebark, ocean spray, Oregon grape, devil's club, thimbleberry, and forbs such as trillium, queencup beadlilly, and ladyfern (Tabor 1976, Franklin and Dyrness 1988).

In the arid, non-forested regions of eastern Washington, the riparian vegetation is usually prominent compared to the surrounding landscape (Hirsch and Segelquist 1979, Kauffman 1988). Historically, thickets of shrubs interspersed with deciduous trees and grasses were common along with some conifers such as ponderosa pine and Douglas fir especially in canyons or rocky-walled valleys (Evans 1989). Examples of native riparian shrubs and trees in this climate include mock orange, snowberry, wild rose, black hawthorn, red osier dogwood, willow, black cottonwood, water birch, and quaking aspen (Knutson and Naef 1997). Currently, conifers are much less common in this type of riparian zone compared to historic conditions.

In western Washington, riparian vegetation is often younger and has a lower profile compared to upland plants (Hirsch and Segelquist 1979, Kauffman 1988). Trees are common and consist of species that tolerate shady, wet conditions. Snags and multiple vegetative layers are also characteristic of this region (Small 1982, Oakley et al. 1985). Small streams usually have a narrower riparian buffer dominated by conifers, while streams associated with large floodplains are generally more dynamic and typified by black cottonwood, willow, and red alder (Fonda 1974, Taber 1976, Topik et al. 1986, Henderson et al. 1989). Other trees and shrubs commonly found in western Washington riparian buffers are vine maple, willow, red-osier dogwood, oceanspray, Pacific ninebark, snowberry, hawthorne, red alder, salmonberry, and red elderberry (Knutson and Naef 1997).

## Plant Growth and Survival

The CREP plants in Washington State are successfully surviving and growing. Growth rates are high for both the arid regions in the east and the wet areas of the west with no significant difference between the two regions in overall plant growth and conifer growth. Deciduous growth on the west side of the state was greater than all other types of plants in all regions.

Comparing the growth of these sites to those in the literature was difficult because most literature sources do not focus on the first five years of growth, the current age of our projects. When comparing to the available information, the CREP sites are meeting or exceeding expectations. In western Oregon, 1+0 Douglas fir plugs and 2+0 bareroot grew 4.2” and 4.3” per year after two years, respectively (Helgerson 1985). Ponderosa pine grew 4.1 and 4.7” per year for plugs and bareroot. In another study, mixed age conifers grew an average of 1.92” per year for Douglas fir and 2.62” per year for western hemlock along the Pacific coast (Hann et al. 2003). British Columbia reported riparian conifer growth rates of 6.1 to 17.6 inches per year (Poulin and Warttig 2005). Most of these growth rates are lower than our conifer rates of 13.6” per year in western Washington and 10.1” per year in eastern Washington.

Deciduous growth averaged 23.5” per year in western Washington and 14.5” in eastern Washington for the CREP projects. In a similar restoration project in western Oregon, red alder grew an average of 39.4” per year (Bishaw 2002). In another study in British Columbia, black cottonwoods (one of the fastest growing deciduous trees) grew an average of 66” per year over a ten-year period (Burns and Honkala 1990). Pacific willow, a commonly used shrub in CREP projects, averaged 13.2-36” per year in Corvallis, Oregon (USDA Soil Conservation Service and Oregon State University Agriculture Experiment Station 1988). Deciduous plants in the CREP projects include a wide variety of deciduous trees and shrubs, many of which are slower growing plants compared to very fast growing species such as black cottonwood and red alder.

Plant survival was excellent at nearly all of the sampled CREP sites. The median percent survival was 95% in eastern Washington and 92.6% in western Washington. Mean survival was 77% in eastern Washington and 87.5% in western Washington. In general, CREP plant survival in Washington has been very successful with only a few sites experiencing large losses. Those losses were due to continued drought conditions in eastern Washington and flooding in western Washington.

Survival results differ greatly in the literature, and depend heavily on weather patterns and environmental conditions, which can vary locally. In an Oregon study, survival of conifers averaged 98% for bareroot stock after two growing seasons and 89% for plugs (Helgerson 1985). However, in a recent restoration project along Beaver Creek in Oregon, survival was about 50% during the first year (due to beaver damage), but after providing better protection, increased to a range of 67-75% after three years (Bishaw et al. 2002). A riparian project in the Oregon high desert reported early survival results of 70-80% for a mix of ponderosa pine, deciduous trees, and shrubs (Fox Creek Farm 2006). The

NRCS plant stocking specifications assume a 15-20% mortality, while the Washington CREP sites are generally performing better than these assumptions.

**Plant Density and Diversity**

Plant species diversity can have a valuable role in riparian buffers by providing a wider array of wildlife habitat and ecological benefits (ex. greater nitrogen fixing by some plants). In addition, different types of vegetation have varying levels of effectiveness for riparian functions. For example, grasses are the most effective vegetation type to trap sediments and filter pollutants (Fischer and Fischenich 2000). They have a moderate ability to prevent bank erosion and a low effectiveness for bank failure prevention and habitat formation. In contrast, trees have a high effectiveness for forming habitat and preventing bank failures with a low to moderate ability to prevent bank erosion, trap sediments, and filter pollutants (Fischer and Fischenich 2000). Shrubs have the highest effectiveness for bank stabilization, a medium ability to trap sediments, prevent bank failures, and provide habitat with a low effectiveness for filtering pollutants. The most effective riparian buffers will ultimately have a mix of plant types as they mature.

Density can have a negative effect on plant diversity. If the forested area becomes too dense, particularly with long-lived conifers, the understory development of shrubs, grasses, and herbs can be stunted (Berryman et al. 2004). In addition to impacting diversity, high conifer densities can lead to decreased diameter growth (Tappeiner et al. 2000). Diversity is a characteristic that develops over time in natural forests. Old growth forests are much more heterogeneous than young forests (Franklin et al. 1981).

The definition of high density varies in the literature. High-density forests were defined by Berryman et al. (2004) as around 740 trees per acre and moderately dense forests around 500 trees per acre. Specifications by NRCS require a density of 300-400 stems per acre for woody species (trees and shrubs) on CREP sites. However, the U.S.G.S. (2000) defined high density as 300 trees (not shrubs and trees) per acre, and the natural density of conifers that developed into old growth forests were estimated as low as 40 trees per acre in their first 50 years of life (Poage & Tappeiner 2002).

When examining total plant density, the NRCS standard is applicable because it includes shrubs and trees, not just trees. Eastern Washington sites have highly variable plant densities, while western Washington density levels are generally above the 300-400 stem per acre specifications. The variable results in eastern Washington are partially due to dense willows in some sites (a normal condition for willow plantings), and interplanting CREP plants under established trees at a couple of sites. This assessment counted only plants planted under the CREP program, not established plants, which would underestimate actual density at those few sites. Most sites with interplanting were excluded from the density estimates, but a couple of sites were included where the majority of plants were from the CREP program. Also, plant survival was correlated with density in eastern Washington.

The greater density levels in western Washington might be due to increased survival, although the correlation was not significant. However, from a biological perspective, it might be useful to continue to monitor the density of the long-lived conifer trees in western Washington CREP sites and thin to recommended numbers, as their density will control the understory development in the future.

The current conifer density of the Washington CREP projects is generally well below the high and moderate thresholds used by Berryman et al. (2004), while some western Washington sites are above the U.S.G.S. threshold at this time. This indicates that while most sites are likely on track towards an appropriate conifer density, some sites may have density issues in the future. Also, most of the projects are young. Of 50 sampled sites, only 4 sites consisted of 6 growing seasons, 7 had 5 seasons, and most (21) had 3 or fewer growing seasons, which indicates that additional plant mortality is likely.

As time goes by, the density should be evaluated on a site-by-site basis with thinning occurring at sites deemed too dense. This is better accomplished by local districts that can analyze on a site-specific basis to determine whether they have an appropriate density for their plant species to support a diverse riparian buffer. Current research suggests that thinning be done in a variable pattern to create patches of differing densities (Carey et al. 1999). This will allow better understory development. Along with density considerations, sites should be monitored for diversity and if natural diversity does not occur, understory planting may be necessary. Diversity of planted materials was good at most western Washington sites and at the Walla Walla sites in eastern Washington (Figure 23).

**Figure 23. Newly established riparian buffer in the Walla Walla district, where high plant diversity was common.**

## Riparian Standards

To address the question of what is an adequate riparian buffer, standards have been developed by numerous entities. The standards differ considerably from each other, ranging from 3 to 500 meters (33-1640 feet) with the largest buffer recommendations addressing wildlife habitat such as the spotted owl (Johnson and Ryba 1992, USFS 1994, Fischer and Fischenich 2000). There are many reasons for these differences including stream size, climate/environment of the stream, different methodologies, and the need to address different riparian buffer functions and goals. A brief review of riparian standards is provided here, focusing on a range of buffer widths that address different riparian zone functions.

Riparian buffers have numerous functions, and each operates from different distances from the stream. Table 1 illustrates the various functions and distances of riparian trees. The tree height is based upon the site potential tree height (SPTH), which is defined as the average maximum height of the tallest, mature, dominant trees for a given site class (USFS 1994). Average site potential tree heights are 175’ in western Washington, 120’ in eastern Washington, and 90’ at high elevations as reported in NMFS (2000). However, differences between sites within these regions as well as different reporting mechanisms result in different potential tree heights. The Forest Practices 4D document reports a range of site potential tree heights from 90-210' in western Washington and a range of 60-120' in eastern Washington. This illustrates two very different recommendations for riparian buffer widths in eastern Washington between two widely used data sources. It also points out the importance of using site potential tree height for each specific area rather than a general average.

Once site potential tree height is determined, the percentage of tree height can be used to determine the extent of provided riparian functions. Table 1 shows that at 30% of tree height, half or more of the full benefits of five major riparian functions are addressed (FEMAT 1993, NMFS 2000, Fischer and Fischenich 2000). These functions include shade, leaf litter, soil moisture retention, bank stability, and nutrient/pollutant filtering, which together comprise many of the water quality functions. At half to ¾ tree height, nearly full functions occur for leaf litter, soil moisture, bank stability, filtering, and sediment control with half or more function for shade and LWD recruitment. This is supported by McDade et al. (1990) who found that 70-90% of instream LWD came from within 50 feet of the stream bank in a mature forest setting. Note that the functions also depend upon what type of vegetation exists in the buffer. Grasses are the most effective filtering and flood conveyance vegetation, while shrubs excel at stabilizing banks, and trees provide the best shade, LWD, and bank failure prevention (Fischer and Fischenich 2000). This demonstrates the need for diverse buffers so that a broad array of riparian functions can be addressed.

The current minimum buffer width for a CREP project is 30% of the active floodplain of the stream, and can range from 35 to 100 feet depending on the site. The actual buffer cannot be less than the minimum at any location of the project. The maximum buffer width that can receive rental is 180 feet measured as an average maximum of the project. The landowner can choose to enroll the minimum buffer width or anywhere up to the maximum buffer width of 180 feet. National Resource Conservation Service (NRCS) standards must be used to restore the riparian buffer.

A 30-53' (30% of SPTH) established diverse buffer on a low slope area would likely fully or nearly fully address soil moisture retention, detrital input, filtering, and bank stabilization with half or more function of shade and half or slightly less function of LWD recruitment. In short, it would significantly address many water quality functions and improve fish habitat, although not to full function for LWD recruitment and shade of larger streams. Wildlife habitat would require a much larger buffer if wildlife habitat is a goal of the project.

Greater flexibility in buffer width (i.e., allowing a 35' minimum buffer) would significantly improve riparian habitat in densely populated areas. Presently, landowners of small parcels rarely enroll in CREP because wide buffer requirements take away a large percentage of their land. In effect, the current wider buffer requirements result in no buffers on these types of parcels. If minimum buffer widths were lowered, more private landowners in the agricultural-urban interface areas would be willing to restore riparian habitat, increasing the benefits to water quality and fish habitat.

Riparian restoration projects funded by other mechanisms appear to have greater flexibility in buffer width. For example, nearly all of the Salmon Recovery Funding Board (SRFB) approved riparian projects targeted the largest classification of streams (Type 1 or S), yet buffer widths ranged from 25 to 200 feet with the majority at 74 feet or less in width (Figure 24) (PRISM database viewed Feb. 2006).

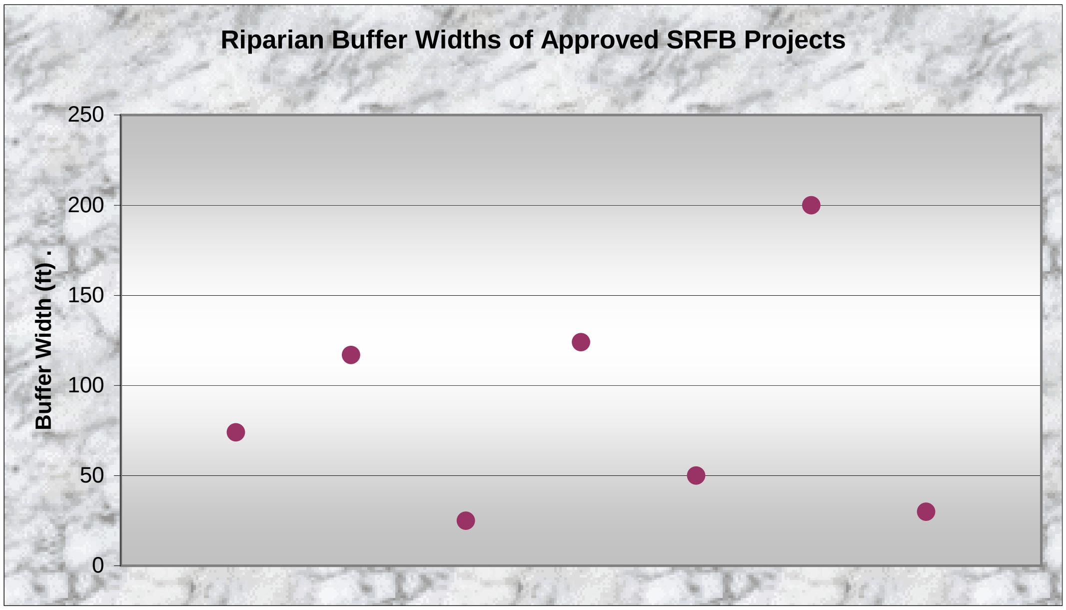
Two riparian functions require very wide buffers. These are wildlife habitat and flood attenuation. The wildlife buffer needs are highly variable and depend upon the species involved. For example, some bird species have very large riparian buffer needs. The WDFW management recommendation for Washington's priority habitats has a buffer width guideline of 250' for Types 1 and 2 streams (Knutson and Naef 1997). This buffer recommendation is very wide, but is intended to cover all fish-related needs including conditions on moderately steep slopes, as well as many wildlife needs. Projects that focus on more specific functions such as water quality and are located on low slopes do not need to plan for such extensive buffer widths. Most agricultural land is on low or moderately low slopes.

In conclusion, recommended riparian buffer widths vary greatly, but it is apparent that even small buffers provide important riparian functions, and as buffer widths increase, so do the protective and functional aspects of the buffer.

**Table 1. Riparian buffer widths needed for various riparian functions. Tree height data from NMFS (2000) citing FEMAT 1993, buffer width in meter data from reviews by Spence et al. (1996) and Fischer and Fischenich (2000). One tree height averages 175' in western Washington and 120' in eastern Washington.**

| Riparian functions relative to distance from stream: | 30% Tree Height | Half Tree Height | 75% Tree Height | 1-2 Tree Heights | Buffer Width (feet) for Functionality (Spence et. al. 1996) | Buffer Width (meters) for Functionality (Fischer and Fischenich 2000) |
|---|---|---|---|---|---|---|
| Root Strength/ Bank Stability | 50-60% | 60-90% | 90-100% | | <30m (98') | 10-20m (33-66') |
| Soil Moisture Retention | 80-90% | 100% | | | | 10-20m (33-66') |
| Leaf Litter and Organic Material (food web) | 50-60% | 60-90% | 100% | | <30m (98') | 3-10m (10-33') |
| Shade (dependent on stream width and topography) | 40-50% | 50-60% | 60-90% | >90% | 25-39m (82-128') | |
| Trees contributing large wood to the system | <40% | 40-60% | 60-80% | 80-100% | 1 site potential tree height; or 30-60m (98-197') in Cederholm (1994) | |
| Sediment Control | | | | | 30m (98') on gentle slopes-90m (295') on steep | |
| Pollutants/ Nutrients (Most filtering occurs in first 10m. Depends on slope and load) | | | | | | 5-30m (16-98') |
| Flood Attenuation | | | | | | 20-150m (66-492') |
| Wildlife Habitat | | | | | | 30-500+m (98-1640') |

**Figure 24. Riparian buffer widths of approved SRFB projects in the PRISM database February, 2006.**




## Biological Function

Riparian conditions are generally degraded in many areas of Washington State with 53% of basins rating poor, 9% poor-fair, 18% fair, 13% good, and 7% data gaps (Smith 2005). Of the 26 districts in the CREP database, 19 (73%) of them have riparian ratings that generally rated poor in their basins, and none had overall good riparian condition ratings for the basin. Basin wide ratings are not site specific, but are generalized over the broad basin area and include nonagricultural land where CREP projects would not be allowed. However, this points out the need for continuing riparian restoration activities.

Even though much more riparian restoration is needed in Washington State, the CREP projects are targeting very important streams. Ninety-seven percent of the CREP projects are on streams identified by the state as “high benefit to fish”. These are the largest streams in the state, and have high benefit to humans and wildlife as well. In addition, 73% of Washington CREP projects directly benefit watersheds that have known usage by ESA listed salmon or steelhead. About half of the CREP projects benefit streams where two or more species of salmon and steelhead have been documented. If bull trout distribution were better known, the percentages of ESA and species number benefits would likely be higher.

Some of the older projects in this program are just entering the stage where additional monitoring can occur to assess biological function, such as shade, water quality, and bank conditions. At a 16 year old riparian restoration site on agricultural lands in Canada, decreased nitrate, decreased sedimentation, increased shade, and decreased plant species richness have been detected

(Oelbermann and Gordon 2006). The decreased plant species is likely related to high tree densities, and some natural diversity decline is expected over time as competition occurs between plants.

The timeframe to contribute LWD is much longer. At less than 10 years, the restored trees can help trap other debris, but is not a supply of LWD (Opperman and Merenlender 2004). From 10 to 20 years, the trees can begin to supply a local source of non-key pieces, and after 20 years, can begin to contribute both small and larger LWD pieces.

It is recommended that monitoring of biological function occur as the projects age. Baseline monitoring has not taken place, but status and eventually trends (status over time) monitoring can be very useful. A minimum sample size of 50 randomized sites is recommended, and this would follow the Environmental Monitoring and Assessment Program (EMAP) protocols (EPA 2006).

## CREP Program Issues

*Plant Densities*

Plant densities for CREP projects are approved by the local NRCS staff or planted to NRCS specs, and those densities can vary from district to district. Some of the densities are thought to be too high and will require thinning at a later time, which will be after the five-year maintenance coverage. The district that brought up this issue had a few sites with high conifer densities when compared to other districts, suggesting that the problem might be inconsistency within NRCS in approving planting densities. The increased density will result in additional maintenance costs or in lower plant diversity and buffer function as time goes by (Tappeiner et al. 2000, Berryman et al. 2004).

*Beaver Problems and Solutions*

Beaver have been reported as a large problem in some parts of the state, especially in Whatcom County. While in the long term beaver can be ecologically beneficial, they can destroy an entire project when the seedlings are young. In addition, there has been concern about the effects of beaver dams constructed in CREP sites, and their potential to alter stream flow on private property not in that site.

Beaver fencing has been used with some success in Whatcom County. If beaver remain problematic, they can be 1) live trapped and euthanized and no permit is needed, 2) killed with a body-gripping trap upon obtaining a free permit from WDFW, or 3) trapped by a trained nuisance wildlife trapper who can relocate them. However, trapping can be costly and impractical. See Appendix 1 for more details.

Bishaw et al. (2002) reported extensive mortality (50%) of seedlings due to beaver and livestock until plant protectors were switched from the meshed Vexar to the smooth sided Protex, which seemed to impede the ability of beaver to climb the protector. After switching types of protectors, seedling mortality due to beaver dropped to about 2% even though beaver trails were still common in the site. The Protex tubes needed maintenance early each spring to make sure they were secure.

*Invasive Species/Weeding*

Weeds are important to control during the first few years of a riparian restoration project because they compete with the riparian plants for moisture, nutrients, and light. They also provide rodent habitat, which can increase the damage to riparian plants. The extent of necessary treatments varies. Weeding during year three of a Douglas fir planting in Oregon had no effect on stem volume or growth in year four, and fertilization had only short-lived effects (Rose and Ketchum 2003). In a riparian restoration project in western Oregon, noticeably less weeds were observed starting at year five when shading was becoming more effective (Bishaw et al. 2002). This indicates that generally, weeding is most important in the first two years of the project, but additional weeding might be needed afterwards in the case of tall invasive species.

The two greatest invasive species problems encountered in Washington CREP projects were reed canary grass and Himalayan blackberry. Reed canary grass is very competitive, can become a solid monoculture, and can grow tall enough to deprive young plants of light. Himalayan blackberry easily outcompetes shorter plants, and can prevent the establishment of shade intolerant trees such as Douglas fir, ponderosa pine, and Oregon white oak (Soll 2004). Neither invasive species provides the desired riparian functions.

Most of the districts in Washington did not have many concerns regarding the current maintenance caps, and were confident that the weed problems would decrease as shade increased. However, some projects have recurring problems with invasive species that require additional maintenance.

*CREP Participation*

Although the Washington CREP has been very successful at establishing healthy riparian buffers, the overall success of the program could be improved. Twenty three percent of the districts account for nearly 80% of the projects (CREP database, Whatcom Conservation District). Several changes have already occurred to increase participation such as hiring a person who manages CREP as their primary job duty and fully funding them by combining CREP programs from neighboring districts. However, there are problems that continue to limit the growth of the program, and these are discussed below.

Low rental rates are a major limitation of the program in eastern Washington especially in areas that irrigate. The low rental rates do not adequately cover irrigation costs and taxes. Because of this, some areas of the state have very few CREP projects. These include Yakima, Chelan, and other nearby districts.

Okanogan, Benton, and Asotin districts have very low rental rates.  Okanogan rates are only slightly more than half the state average.  The same problem has been identified in the Oregon CREP (Bierly 2005).

In western Washington, one of the greatest problems is that parcels are constantly shrinking in size due to developmental pressure, and CREP is not a good fit for small parcels because of large buffer requirements and cumbersome paperwork.  The future in western Washington is likely towards an increase in smaller parcels, and the cumulative effect of including small landowners could be a significant ecological benefit.  A different program would be better for small parcels, and this program ideally should have much simpler paperwork, such as a state plan that doesn't rely on federal approvals.  Another need for such a program would be to allow a minimum buffer size of 35 feet regardless of the floodplain so that more people will be able to participate.  Otherwise, the larger buffer requirements will prevent small acreage landowners from planting any buffer because the large buffers take up too much land.  Many riparian benefits occur within the first 30 to 53 feet in a buffer, and the 35-foot buffer would still provide significant benefits, and would certainly be better than the alternative of no buffer.

There are two types of acreage caps that are thought to limit CREP enrollment, but actually don't.  The CREP program was authorized for 100,000 acres in 32 counties, which resulted in a limit of 3,000 acres per county.  Anything above 3,000 acres needs State Office approval.  Because many of the counties are significantly under their 3,000 acres, those acre-credits can be transferred to other counties that are close to their limit.

In addition, CRP acreage limitations have resulted in eight eastern Washington districts that are close to or have reached their acreage caps (Adams, Benton, Klickitat, Franklin, Walla Walla, Garfield, Douglas and Asotin).   In order to enroll CREP on agricultural lands, potential CREP buffer areas will need to be reclassified as marginal pastureland to be eligible.  This is a U.S.D.A. requirement to protect agricultural lands.  For most lands, this will not create any problems, but in a very few cases, a reclassification may reduce federal subsidies.

The stream miles cap may be more limiting to the growth of the CREP program. Qualifying stream miles have been designated and mapped for each participating county.  To-date, if a CREP project is desired on a non-designated stream, the miles can be reduced elsewhere in that basin to accommodate the added stream.  However in very active districts, stream mile "trading" may need to cross district boundaries in the future.

*CREP Process Complications*
The roles for various agency staff need to be more clearly defined.  Staff from conservation districts, NRCS, and FSA must work together to approve each

CREP project. However, the roles for each agency are blurred, and project approval is handled differently from district to district. A workshop is needed to bring together staff from the three entities to better clarify roles and program guidelines and to hear the same messages.

Another problem is that the paperwork is too cumbersome, not only for district staff, but also for the landowners. Some of the same information is required for three different sets of forms, and landowner signatures are required too many times.

*Increased Local Control*

Some projects have specialty situations that require additional approvals and are currently required to get these at the national level. This is seen as unnecessary and time consuming. It is understood that a review is needed, but a state or county level review makes more sense from not only a time perspective, but from knowledge of local conditions. Types of agriculture and watershed conditions are much better understood at the local level than at the national level.

# Recommendations

## CREP Renewal Recommendations

The Conservation Reserve Enhancement Program has been highly successful in Washington State with high plant growth rates, excellent survival rates, and generally diverse buffers. The sites have overwhelmingly targeted the larger streams in the state that have high fish, wildlife, and human benefit. The majority of the sites are also addressing a major limiting factor (poor riparian conditions) for salmon and steelhead on the Endangered Species List. However, riparian conditions have been so extensively degraded, that there remains a continuing need for restoration. For these reasons, renewal of CREP is highly desirable.

During the renewal process, several changes should be sought to make the program more successful.

- Seek a way to incorporate a minimum 35' buffer regardless of floodplain option into the CREP program so that small parcels can be enrolled more easily. Currently, larger buffers take up a much greater percentage of these lands resulting in non-participation and no buffers at all. Programmatic guidance is needed clarifying that projects on small parcels are as important as large projects in restoring and protecting riparian buffers.
- Expand the eligible practices to potentially include wetland restoration, hedgerows, and grass filter strips, and other practices as developed by the CREP committee with input from FSA and resource agencies.
- Seek changes in the Washington CREP to include all types of agricultural lands in Washington, such as orchards and vineyards.
- Rental rates are still too low, and will be a larger problem in the future, as more financial incentives will be needed to motivate remaining landowners. Soil alone should not determine rental rates. The current rates do not cover irrigation and taxes in some areas of eastern Washington. The current rates are also not competitive with developmental pressure in western Washington. Options should be explored in the CREP Committee.
- Reestablish the original SIP payment to $10/ac/contract year. This payment was intended to provide landowners with working capital to install BMPs. Material costs have increased substantially since the program started and this incentive payment is even more important now.
- Seek an increase in plant costs so that the actual maximum price of 1.75 is covered. This is a 25-cent cost increase for some plants and still well under what many other agencies and entities are paying for riparian restoration plants.
- Increase caps for structural practices such as fence and water systems. Material costs for these BMPs have increased substantially since the hold-downs were established.

- Seek changes in next contract so that local (not national) committees can approve additional costs (ex. off-site watering).
- Examine the paperwork process and forms and try to simplify. Can the forms be electronic and linked so that information in common only be entered once? Can the paperwork burden to the landowner be reduced?
- Reinforce agency roles and oversight especially in areas that require technical expertise.

**Small Parcel Restoration Program Recommendations**

- Consider creating a separate program to address habitat restoration on small parcels. Ideally, this program would have smaller minimum buffer requirements, such as 35' minimum buffers regardless of floodplain, simpler paperwork, and be state-funded to reduce federal paperwork and approval processes. These types of parcels are becoming more common as development pressure increases, and without such a program, conservation and restoration will likely not occur.
- If such a program cannot be developed solely within state government, consider negotiating these components into the CREP renewal process.

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# Appendix 1

# Beaver Control Options

### Beaver Trapping

The following information is from a conversation between Carol Smith (Conservation Commission) and Sean Carrell (WDFW Enforcement). There are three major options for directly dealing with beaver. All of these apply to private lands and private landowners. If public land is involved, the situation is more restricted unless nearby private land is threatened. Here are the options for private landowners.

1) Whenever damage to private land or property occurs, the landowner may live trap the beaver with no permit or contact needed. However, if the landowner is not trained as a certified nuisance wildlife trapper, the animal cannot be moved and released somewhere else. It must be euthanized. The recommended methods for euthanasia are provided in the accompanying pdf document located in a separate file.
2) A landowner may also use a body gripping trap (instant kill) if they have a permit. The permit can be obtained from WDFW, and is free. It lasts 30 days and can be renewed. The landowner will be asked to provide some sort of documentation for any one of the following situations: property damage, risk to human safety, risk to livestock or pets, timber loss, risk to ESA listed species, or research. Only one of these is needed to justify the permit.
3) The landowner or management agent may hire a certified nuisance wildlife trapper, who is then able to either live trap and move the animal or use a body gripping trap.

If a dam needs to be disassembled, the local WDFW habitat biologist should be contacted first. Usually in cases of risk to property or safety, dam removal is allowed.

### Conservation District Experiences with Beaver Control

Kitsap Conservation District coordinated and installed a beaver deceiver in a dam that was flooding pastureland on two properties. The project consisted of installing approximately 100 feet of 4” corrugated pipe through the dam area. About 50’ of the pipe was installed above the dam and the remainder below. The pipe was buried through the dam and laid on the pond ground surface above and below. The pipe was weighted with a heavy chain. The project was completed in 2000 and has been functioning ever since. For information call Brian Stahl, (360) 337-7171 ext 23.

In Whatcom County, several methods of beaver control have been tried. Trapping appears to help control beaver if done early, when new beaver are colonizing an area. It is not a permanent solution, as new beaver tend to move in (Dr. Robert Barker, personal communication). An effective fencing method used 3' and/or 4' galvanized wire fence with 2"X4" mesh with a post every 10 feet at an approximate cost of $2.00/foot. The bottom foot of the wire was laid on the ground on the streamside of the fence, and after 6 years, there has been no penetration by beaver except in one spot where the fence was on very soft ground and went underwater for weeks in the winter (Dr. Robert Barker, personal communication). This type of fencing costs about $500/acre and protects around 500 trees.

Cages made with the same wire mesh and held in place by rebar or steel fence posts were also tested. The beaver can push these over and gnaw the tree through the mesh until it falls over, and then they chop the tree. The cages cost upward of $3.50 per tree. Cages cost a lot more to protect even the first 30' of riparian area, and beaver will go more than 100' to get to the trees.

Electric fencing with two strands at 10" and 18" of height over the center of 6' wide landscape fabric is also effective if it isn't submerged for a good portion of the year and if it is maintained fairly weed free. Even with the weed barrier in place, reed canary grass can fall on the wire will need continued maintenance. Installation of this method costs less than fencing, but maintenance could be costly.

Beaver food preferences in this area are cottonwood, willow, young cedar, and even spruce. They have not chewed on alder as much, and have left Oregon ash, spirea, and ninebark alone.